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WRITTEN SO YOU CAN UNDERSTAND IT

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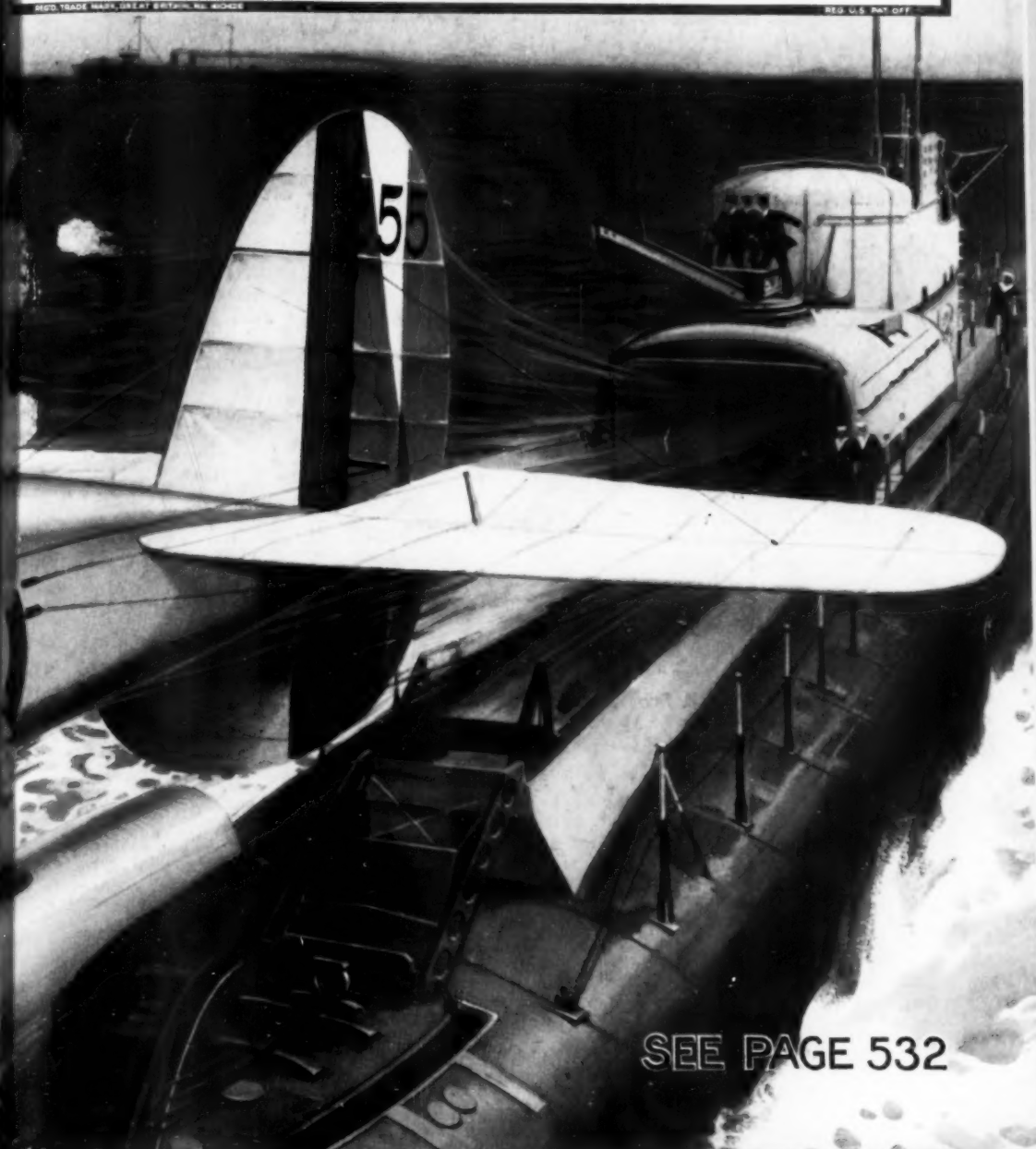

SEE PAGE 532

Three Chicago food experts invent a delightful new food that is revolutionizing the doughnut business.

Here's an Amazing New Business That Pays Up to.... $1,000 a Month

Here is a surprising new opportunity. Now you can immediately become the owner of a big business that is paying others from $75 up to $250 a week. There is no "Red Tape"—no delay. Wherever you live there are quick, easy profits waiting for you to grab them. Just mail the coupon for full details.

Individual Plans to Fit Every Need

FULL TIME

You can start a Brown Bobby shop with floor space as little as 6 by 6 feet. Sell retail and wholesale.

Thos. Minch, Fla., made $3,000 his first 3 months.

PART TIME

Invest a few dollars in this new business and get someone else to run it for you. A few hours of your time each week can easily bring you $50 up to $150 a week extra cash.

SPARE TIME

Start at home. Make money like Mrs. Nelson, Ill., who sold 90 dozen Brown Bobbys at retail in one week, then went out to triple her profits through wholesale business.

MEN, this is absolutely new! A real red-hot money-making opportunity! Something every red-blooded man has always longed for. It's a chance to jump into business for yourself and make more money every week than the average man makes in a month!

Surprising, yes, almost incredible as it may sound, we actually start you in a **proven business!** The first day's profits often run from $18 to $55—and a business of $350 to $600 the first month is not exceptional for ambitious men or women.

A Sensational Big-Money Plan

There is just one thing you need to make a "go" of this business, and that is the ambition to make real money. We give you all the plans, advice and help needed to make a big success right from the jump. We supply you with the equipment to make an amazing new food—a **greaseless** doughnut baked by electricity! You sell to homes, bakeries, delicatessens, groceries, restaurants, etc., at a profit of 150% to 600%! No wonder the dollars simply pour in!

A New Food Secret

The **greaseless** doughnut is altogether novel and unique. It's a crispy, flaky, delicious new kind of doughnut cooked without one drop of oil or grease. Easily digested by everyone. More appetizing than old-style doughnuts ever were. Yet costs you less to make. This new business is copyrighted under the trade name "BROWN BOBBY," so there is no competition.

Everyone likes doughnuts. Millions of old-style doughnuts are sold every day. Now you can bake and sell the perfect doughnut—the toothsome BROWN BOBBY **greaseless** doughnut that sells four times as fast as any other.

Start at Once—Anywhere

In this limited space I am able to suggest only the bare possibilities. The details are even more sensational than the facts given here can indicate. I am looking for sincere, ambitious, wide-awake men. I offer such men a plan that is a real eye-opener. The first week's profits usually amount to more than your entire investment. After that it is up to you entirely whether you will make $300 or $1,000 a month clear profit.

Men and women start in this business daily. You do not obligate yourself in any way by mailing the attached coupon. So get the details of this amazing new idea at once. Decide for independence! Fill out and mail the coupon today—NOW—THIS MINUTE!

FOOD DISPLAY MACHINE CORP.
Dept. 3-K, 500-510 N. Dearborn St., Chicago, Ill.

Food Display Machine Corp., Dept. 3-K,
500-510 N. Dearborn St., Chicago, Ill.

Rush me details of your plan for a "Brown Bobby" business of my own.

Name .....

Address .....

City ..... State .....

FOOD DISPLAY MACHINE CORP.
Dept. 3-K, 500-510 N. Dearborn St., Chicago, Ill.

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This One Unique Floor Machine

Scrapes

Takes off the old dingy shellac or varnish and sandpapers the wood to velvet smoothness.

Polishes

Waxes the floor and then polishes it. Result is far superior to handwork and you use much less wax.

Scrubs

Here's the way to clean tile, cement or marble floors. Fast. Efficient. No back-breaking drudgery. No splashing.

The electrical way of doing over floors. Plug into an electric light socket like a vacuum cleaner. You don't even push or pull — you merely guide the machine.

COSTS but a FRACTION of what a contractor would charge for doing over your FLOORS . . . so amazingly SIMPLE you operate it YOURSELF

YOU'D be surprised how beautiful your floors *could* be. They may look dingy and disreputable now, but how they'll gleam and glisten when done over the *electrical* way.

Instead of pulling rugs over the ugly worn spots, as you may be doing now, you'll be so proud of the lovely finish that you'll hate to cover up a single inch.

Can't you picture how much better your furniture will look . . . and your draperies . . . and rugs!

Can't you just hear your friends asking whether you've had a *new* floor put down?

How amazed they'll be when you tell them that you actually did over your old floor *yourself* . . . that the marvelous improvement was entirely due to *your own* efforts!

Yet that's just what you *can* tell them. The Ponsell Electric Floor machine enables you to scrape, sandpaper, wax and polish your old floors without bringing a single workman into your home.

Too good to be true? Not a bit of it. That's only *one* of the advantages. In addition, you save money because the machine costs but a fraction of what a contractor would charge you to do over your floors.

Then, too, the machine refinishes your floors in such a way that they are no trouble at all to keep looking beautiful all the time.

It's astonishing how quickly and easily floors can be done over with the aid of electricity. The *head*-work YOU do; the *hard* work you leave to the machine.

You plug into a socket just as you would with a vacuum cleaner. In a few minutes you are running the Ponsell like an expert and your floors are on the way to a vast improvement.

Good-by, Drudgery!

When floors are done over by ordinary methods they have to be refinished every few years; and is no easy task, as you well know, to keep them looking presentable from day to day.

But when you do them over the Electric way, you never have to refinish them again and, what's more, the machine takes care of them for you forever after.

A few minutes' polishing each week, an occasional rewaxing (operations which the Ponsell makes absurdly easy), and your floors become the constant envy and admiration of your friends.

For Your Business Too: Thousands of leading firms keep their floors spick and span with the Ponsell. Far cheaper than hand labor. Write for information. See coupon below.

TEAR OFF . . . FILL IN . . . MAIL TODAY

Ponsell Floor Machine Co.
220-30 West 19th Street,
Dept. PM1031, New York City

Please mail me information regarding your Electric Machine. I am interested in (business) floors. (residence)

Name .....

Address .....

City ..... State .....

PM1031

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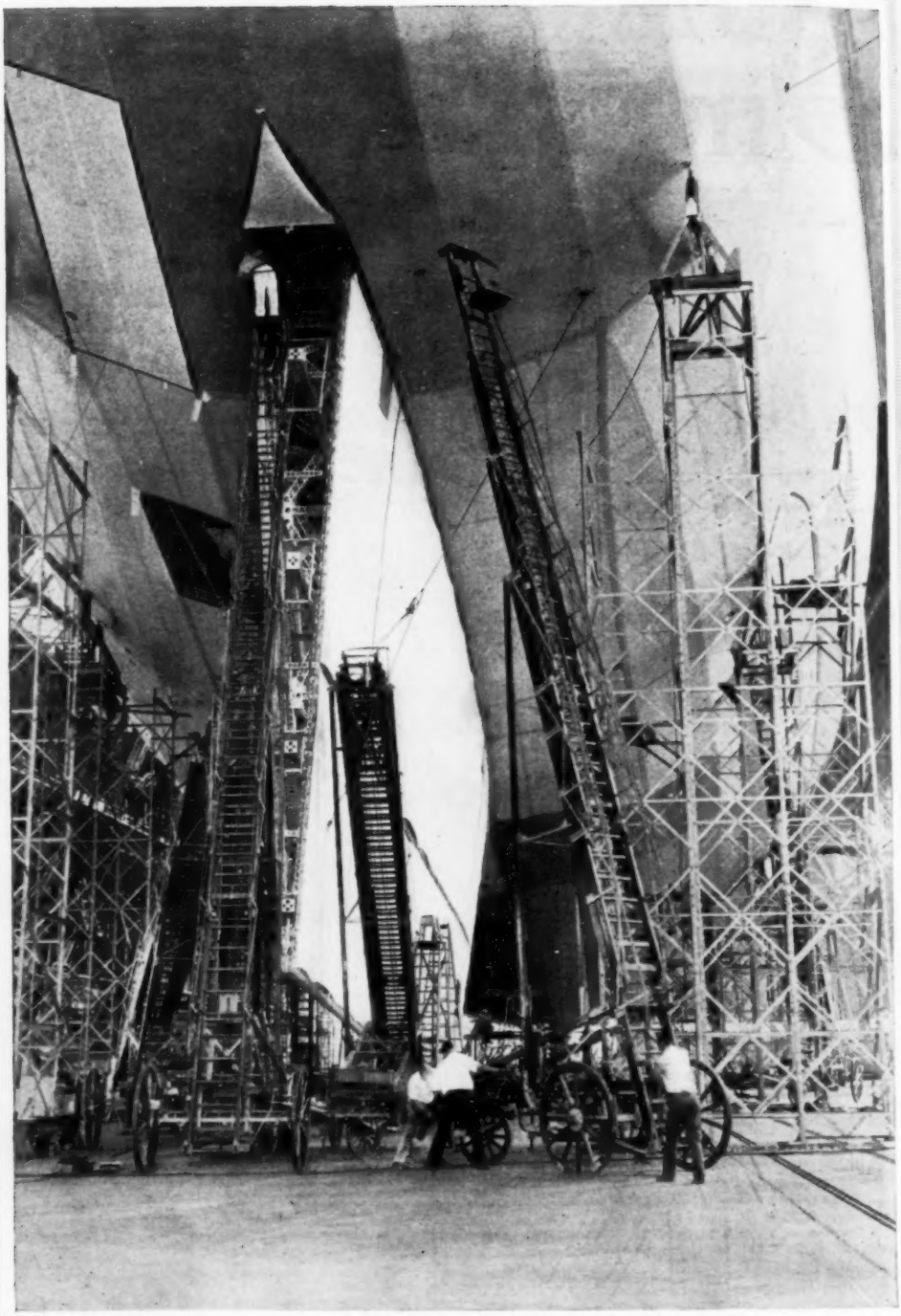

Workmen Put the Finishing Touches on the Lower Fin Which Contains the Auxiliary Control Cabin of the Navy's New Giant of the Air, the "Akron"

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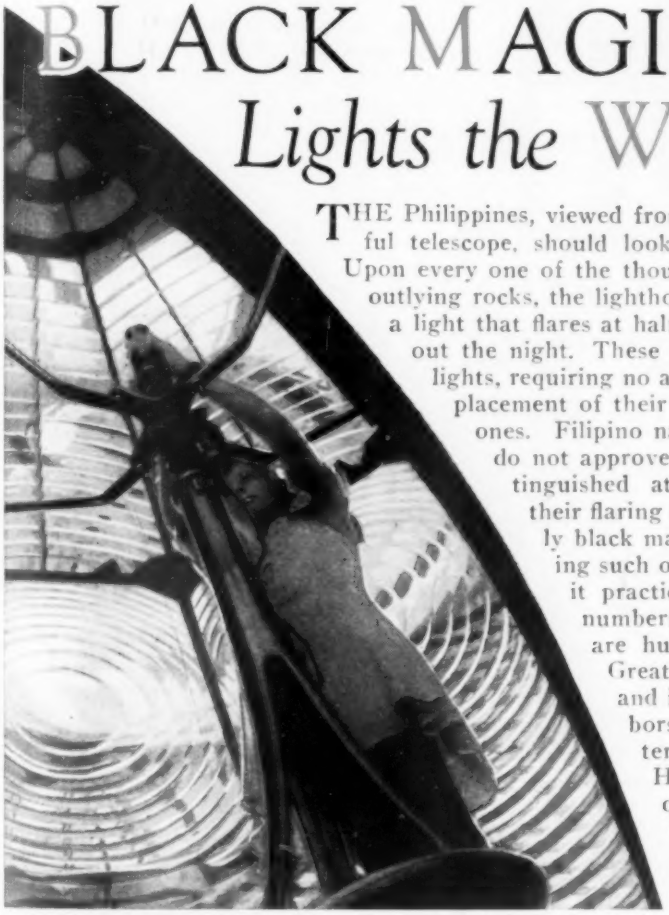
BLACK MAGIC *Lights the* WATERS



Million-Candlepower Lighthouse, the Lens of Which Is Five Feet in Diameter and Seven Feet High, Made of Cut-Glass Prisms, Highly Polished

THE Philippines, viewed from the moon with a powerful telescope, should look like a swarm of fireflies. Upon every one of the thousands of small islands and outlying rocks, the lighthouse service has established a light that flares at half-minute intervals throughout the night. These are automatic "keeperless" lights, requiring no attention save occasional replacement of their acetylene tanks with fresh ones. Filipino natives of semi-savage tribes do not approve of these lights, which, extinguished at daybreak and resuming their flaring at nightfall, are so obviously black magic. The cost of maintaining such outfits is so small as to make it practicable to establish them in numbers almost infinite. There are hundreds of them along the Great Lakes and the Gulf coast and in Atlantic and Pacific harbors. They dot Alaskan waters. Three, off the coast of Honduras, are visited only once in six months. The "magic" depends upon a very simple contrivance. A tiny pilot light burns day and night. A vertical bar is painted black. Set around it are three smaller vertical bars, goldplated. A glass bell serves as a cover. When daylight falls upon the device, the black bar, absorbing warmth, expands, its length slightly increasing, while the three small bars, reflecting the light, are unaffected.

By this means is developed a certain amount of energy, enough to actuate a valve which stops an outflow of acetylene gas from a tank. Thus, in early morning, the flares are discontinued, but at nightfall the black bar cools and shrinks in length, causing the valve to open and liberate the gas.

One of the weirdest of sailors' superstitions has to do with so-called "shouting rocks," from which during storms the outcries of drowned and long-dead mariners are supposed to be heard.

There are today a number of shouting rocks along our coasts, with mechanical voices that are audible at distances of several miles, emitted from giant megaphones. They are human voices, originally recorded on phonograph disks, but amplified to stentorian bellows. "Danger!" they yell. "Keep off the rocks!" They are turned on when fog prevails. But the real magic of this kind is performed by radiophone. It may be on a rocky promontory that the requisite apparatus is set up. The captain picks up his wireless telephone and listens, to hear a voice shouting, "Point Judith light!" Point Judith is near Newport. Every five seconds the cry is repeated, the mechanism on shore being a phonograph which, run by a motor, yells into a transmitter.

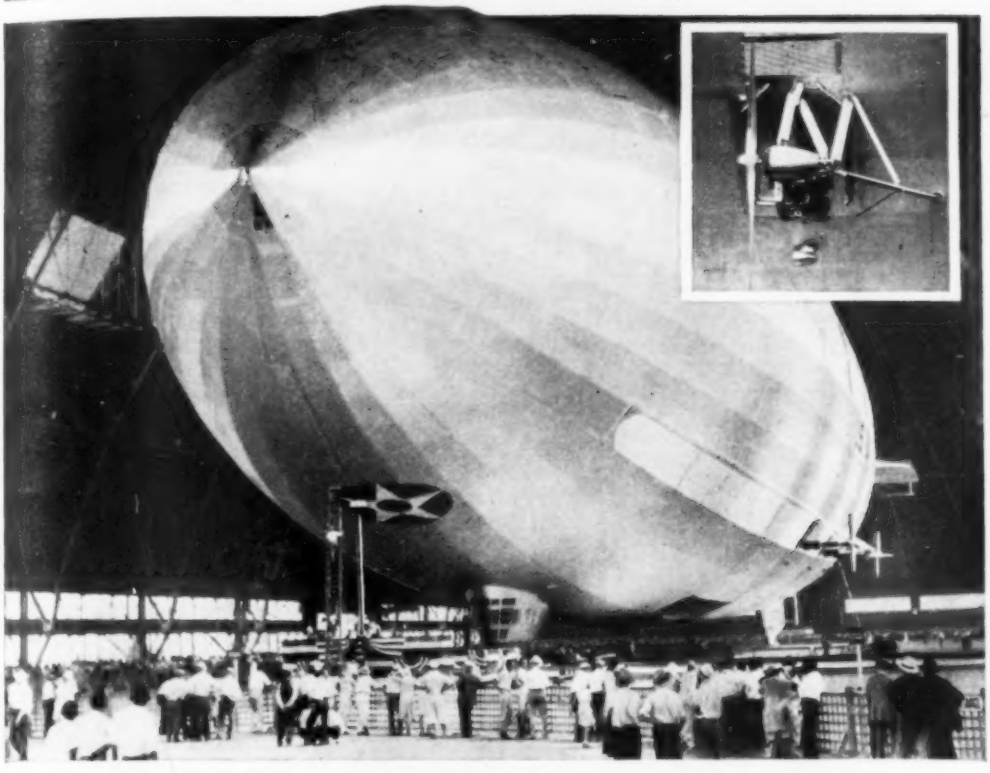
A mighty megaphonic voice was established a few years ago at Falkner's island, off the Connecticut shore. It was provided with eight enormous horns, each of them seventeen feet long and seven feet in diameter at the mouth. The apparatus was installed on a circular platform, on which it rotated, the great horns crying out to all points of the compass with a sound reach of twenty miles. The tremendous vociferation, at intervals of fifteen seconds, was uttered by each megaphone in its turn, with a different combination of long and short howls for each compass point, thus giving to mariners accurate data on directions.

The newest bell buoys have a magic all their own, being wonderful noise makers. They employ a drum, which, as it rises and falls on the waves, turns several wheels. To each wheel a tongue is attached, engaging with a ratchet in such a way as to strike a bell every time the drum goes down or up. Thus the buoy mechanism is operated by the waves.

The magic of the intermittent light has been extended to the bell buoys of newest type. They give warnings near dangerous shoals and along harbor channels, or, when fog blankets them, send sound to replace danger light.

Compressed-Air Foghorns of a Lightship, Top; Sun Valve, Center; and a "Keeperless" Lighthouse

Big Dirigible Is Steered Easily by Propellers



The Giant Dirigible "Akron" as It Appeared When Christened by Mrs. Herbert Hoover; Inset Shows Details of the Movable Propellers, by Which the Ship Climbs, Descends and Steers

Despite its huge proportions, the "Akron," the world's largest dirigible, is maneuvered with as much ease as a much smaller craft. This is due in part to its five movable propellers. By changing the position of these screws at will, the pilot of America's queen of the air is able to alter its direction almost the moment the propellers are moved. Some idea of the size of the great ship is obtained from the head-on view, taken as the dirigible rested in its hangar at Akron where it was constructed.

INSECT-PROOF TIMBER ADVISED FOR USE IN BUILDINGS

Spraying of timbers or woodwork with poisons intended to rid buildings of termites, or white ants, is of no real value, according to the department of agriculture. The only effective remedy known, experiments have shown, is the provision of termite-proof materials for foundations. The danger of collapse of a building from termite damage to timbers, however, has been exaggerated, and the department claims such danger constitutes a negligible risk, although it is true that, where termites have infested a building for many years, some of the timbers may become so weakened as to require replacement. Radical reconstruction of the foundation is the only permanent cure for buildings infested with termites, and spraying or removal of bad timbers can, at best, be only a temporary remedy. Foundation walls of concrete and stone with all openings filled with mortar, and mechanical barriers, such as metal shields, used where necessary, protect woodwork against the ants.

"Gulls of War" Are Launched from New Sub

Two Views of a British Submarine Which Carries an Amphibian Airplane in a Hangar on Deck; the Plane Has Folding Wings and Is Launched from a Catapult at Fifty Miles an Hour

One British submarine is equipped to serve as mother ship for an amphibian airplane, thus combining in one unit the eyes of the navy above and beneath the sea. The plane is packed inside the boat when it submerges and can be launched off the deck within six minutes after the vessel comes to the surface. The submarine contains a water-tight hangar on the deck in which the plane rests when the boat submerges. The amphibian is equipped with folding wings in order to fit the hangar. On the deck of the vessel is a catapult from which the bird of war is launched at a speed of fifty miles an hour. When the submarine rises, the hangar is opened and the plane is moved onto the catapult, which is ready to operate as soon as the engine is started and the wings are opened, both these operations proceeding simultaneously. The new submarine was a feature of the navy-week celebration recently held at Portsmouth and was the center of interest to the crowds that watched the pageant.

STATIC SHOWS AS BLACK SNOWSTORM BY TELEVISION

Radio listeners who have wrestled with the problem of eliminating static from their sets find the same pest awaiting them in visible form when they install a television receiver. Static manifests itself on the television screen in the form of a black snowstorm and the black snow usually falls in summer since the television set, like the radio receiver, suffers more from static in summer than in winter. In television the noise of static is translated into dark spots instead of ear-splitting crashes and these appear in a form resembling black snowflakes. Radio engineers believe television will eventually solve the static problem as has been done in broadcasting audible programs, by increasing the power and improving transmission, pickup and reception apparatus.

Easy Crossing of Streams Is Only One Advantage of These Boat-like Rafts Which German Water Sportsmen Are Using

ONE-MAN RAFT BOAT IS DRIVEN BY TWO-BLADED OARS

One-man raft boats, propelled with two-bladed oars, are used in the latest water sport in Europe. The boats are made of two stringers ten feet long, joined by convenient crosspieces and braces. A man soon becomes expert in handling this inexpensive craft, which is non-sinkable and almost impossible to capsize.

ELECTRIC LIGHT INSIDE PURSE FLASHES AS BAG OPENS

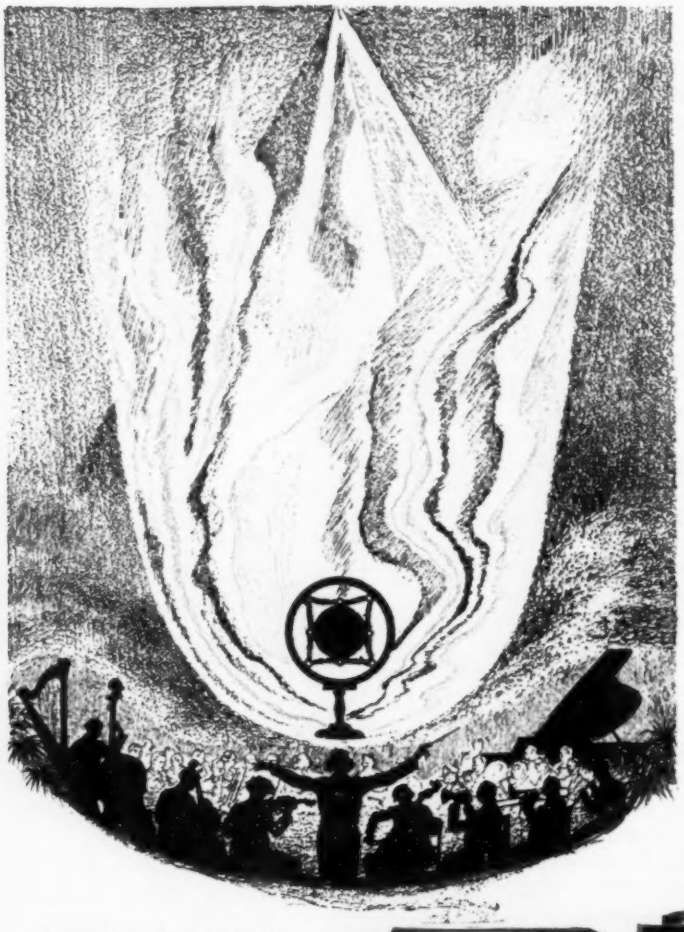
Rummaging inside a handbag for some small article and finding it by the sense of feeling alone is no longer necessary. A bag is now being offered that is equipped with a small electric light. The light flashes on when the purse is opened.

Handbag with an Electric Light Inside That Flashes On When the Purse Is Opened to Reveal Its Contents to the Owner

CAPACITY OF PHONOGRAPH DISK DOUBLED BY NEW PROCESS

Twice as much music as formerly can be recorded on a phonograph disk by employing a recently developed material for it. The records are made of durium, a synthetic resin which is very tough and at the same time flexible. The improvement, which permits the playing of an entire selection of concert music from one record, is effected by reducing the thickness of the walls between the needle grooves. A special fiberboard is coated with the durium and on this the recording is made. The disk can stand much abuse and, because of its durability, the needle grooves are placed very close together, with twice as many channels to the inch as in ordinary records. Such records also wear longer than the latter.

Radio Music Turns to Color in Your Home



Color has invaded the field of radio, making it possible for the listener to receive the music over the air and have it interpreted in terms of color in his home. Telecolor, the apparatus which automatically produces color by means of music, and synchronizes the colors to the music, is a far cry from the color organs that produce lighting effects from a series of switches operated by a keyboard, for it operates just as automatically as the radio which brings in the sound. Through the use of thyratron tubes, thousands of watts of light may be controlled by a few microwatts of acoustic power, changes occurring in accordance with rapid fluctuations of the input, and this is the secret of telecolor. The music is picked up through a microphone in a theater, or a radio or phonograph in the home, and after amplification, passes through a series of filters, each picking out certain tones. The filters in turn are each connected through a thyratron tube to the respective colors representing the mood of that pitch. The colors are arranged to fit the types of music, red, for instance, representing warm or exciting melodies; blue, cold, tranquil or serene, and green the neutral, peaceful, soothing strains. Since it is possible to match every color by mixing lights of red, green and blue, these three are used, with white lights, to permit degrees of saturation. The music thus controls these colors, which are thrown on a screen in the home or used to flood the interior of a theater, and it is even possible to extend the light play to the control of water in fountains, the flow following the mood of the music. The color is not transmitted by radio, but op-

Cabinet Containing Apparatus Which Interprets Radio Music in Terms of Color in the Home, and an Example of Color Music

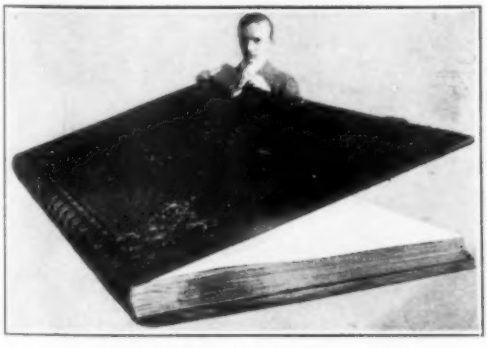
grates from the sound carried by the wave whether the sound emanates from a radio, phonograph or other instrument. Through the changing of connections, lighting combinations can be altered, enabling musicians to write music and work with the device as with an orchestra.

FUTURE CAR SPEED SET AT SEVENTY FIVE MILES

Seventy-five miles an hour will be the normal road speed of automobiles in five or ten years, automotive engineers predict. The increased speed will be accompanied by revolutionary changes in design and construction looking to greater safety. These changes will not be toward larger and more powerful engines, but rather toward streamlining. Even removal of front lamps will increase speed.

BOOK THAT WEIGHS TWO TONS IS TWELVE FEET LONG

Germany boasts a book that weighs two and one-half tons and which is more than twelve and one-half feet long and about four feet wide. It is known as the German prince atlas and has covers of veneered wood. The huge volume recently underwent a restoration process to remove the ravages wrought by time.



German Atlas Which Weighs Two and a Half Tons and Is Twelve and One-Half Feet Long

Motorboat Powered with an Engine at the Rear, Which Operates an Air Propeller; Note the High Cabin and Streamline Design

AIR PROPELLER ON MOTORBOAT INCREASES ITS SPEED

Driven by a powerful motored propeller, a large motorboat attracted much attention in Russia recently when it competed in a race with other craft of the water-propeller type. The boat is of streamline design with a high cabin and engine and propeller mounted at the rear.

LARGEST LIVING THING IS TREE IN SEQUOIA NATIONAL PARK

After precise measurements of the big trees of California, a committee of engineers has decided that the General Sherman sequoia in Sequoia National Park is the largest living thing on earth, with the General Grant tree a close second. More than 1,000 measurements and calculations were necessary to determine that the General Sherman redwood was champion. It has a volume of 600,120 board feet, a height of 272.4 feet, a circumference at the ground of eighty-eight feet, and one limb alone has a diameter of over six feet. If made into lumber, it would provide 30,000,000,000 matches or forty five-room houses and a train of thirty cars would be needed to transport its trunk. The General Grant tree contains only nine-tenths of the volume of the champion, but it is larger around the base and higher.

BURIED T

From the Depths of the Sea to Cocos Island Hoards of Hidden Gold Lure the Adventurous and Ingenious to the Search

Diving Bell That Can Move over the Ocean Floor, Equipped with Armlike Crane; Shore of Cocos Island at Right

LIFTING power of an eighteen-foot tide is being utilized to raise the steamship "Islander" which sank Aug. 15, 1901, in Stevens Passage, nine miles from Juneau, Alaska, with three millions in gold dust and nuggets aboard.

A heavy barge with a series of winches along the sides is being anchored above the sunken ship and lines let down to be secured around the hulk. The salvagers expect to repeat the process of taking up the slack in the lines at each low tide and move toward the beach as the tide rises. This is expected to take between three and four months, according to Frank Curtis, head of the project.

A novel diving apparatus, recently invented by E. H. and C. H. Wiley, is making possible operations at the

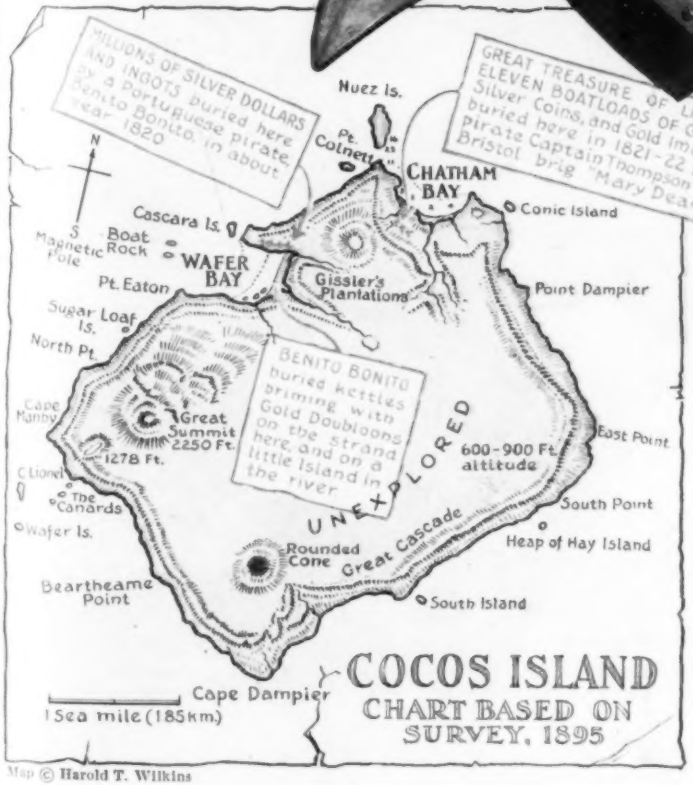
Courtesy Wm. Beebe

TREASURE!

high-tide depth of 365 feet. This apparatus has tractor treads for moving about on the sea floor and a crablike claw grappling arm—both operated by the occupant. It is propelled by electricity, and its occupant can work under water for twelve hours if necessary. In a previous expedition, headed by the inventors of this novel submarine bell late in 1930, much of the "Islander's" superstructure was removed and considerable work was accomplished before lack of funds and a storm forced their withdrawal.

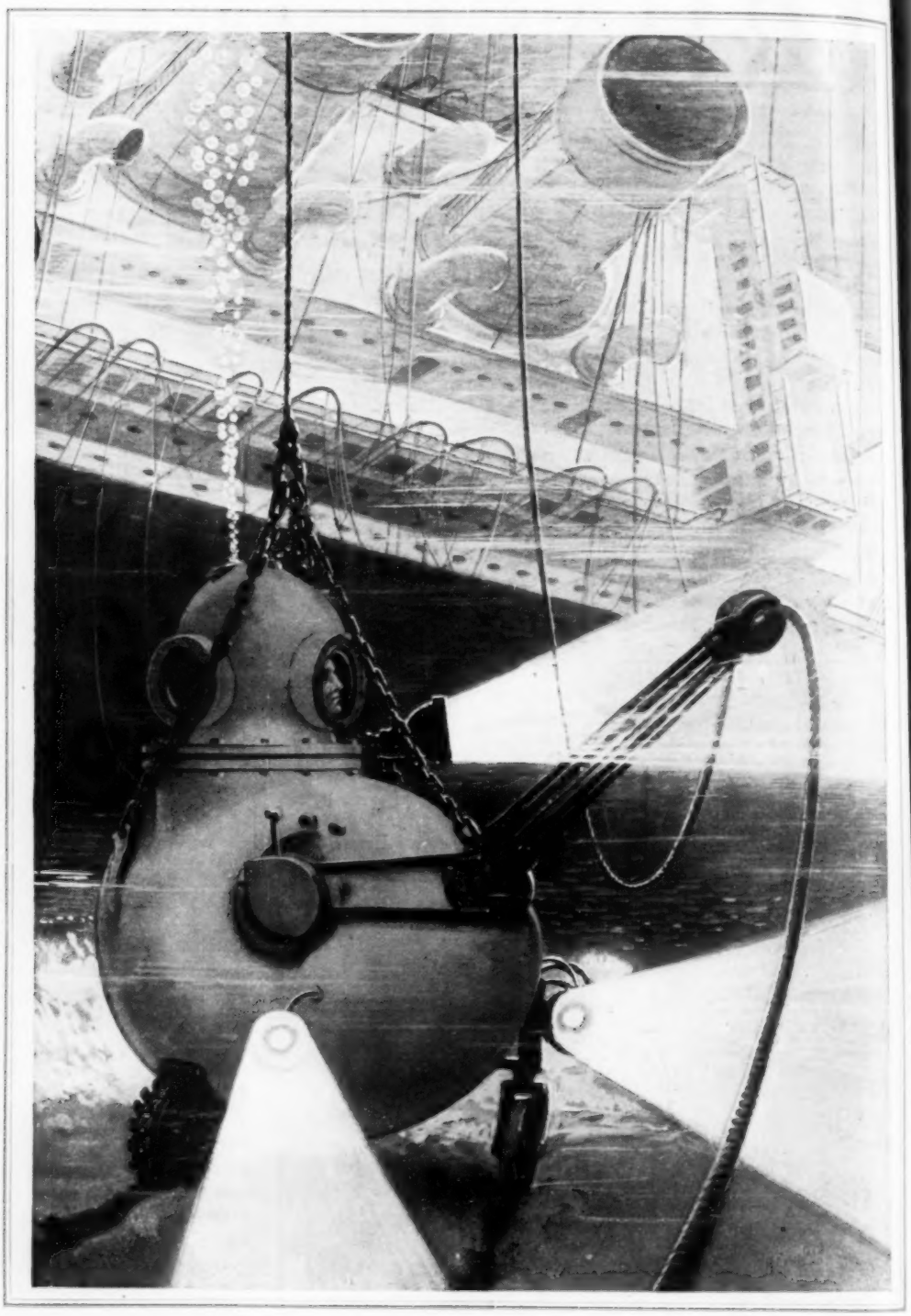
A feature of this bell is that the operator breathes under normal pressure. No air is forced into the bell, but is circulated by ordinary pumping. How agile the crab claw has proved itself is shown in the dishes and bottles which the operator picked out of the ship's pantry in the 1930 expedition. The bell has withstood pressure at a depth of 900 feet.

Wife of the Inventor of the Bell, and Bones of a Miner Who Went Down on the "Islander"; Old Treasure Map, Left


MILLIONS OF SILVER DOLLARS AND INGOTS buried here by a Portuguese pirate. Benito Bonito. in about year 1820
GREAT TREASURE OF LIMA. ELEVEN BOATLOADS OF GOLD Silver Coins, and Gold image buried here in 1821-22 by pirate Captain Thompson of Bristol brig "Mary Dear"
Nuez Is.
Pt. Colnett
CHATHAM BAY
Conic Island
Cascara Is.
Boat Rock
S Magnetic Pole
WAFER BAY
Pt. Eaton
Gissler's Plantations
Point Dampier
Sugar Loaf Is.
North Pt.
BENITO BONITO buried kettles brimming with Gold Doubloons on the strand here, and on a little Island in the river
Great Summit 2250 Ft.
1278 Ft.
600-900 Ft. altitude
East Point
UNEXPLORED
Cape Manny
C. Lionel
The Canards
Wafer Is.
South Point
Heap of Hay Island
Rounded Cone
Great Cascade
Bearthearne Point
South Island
Cape Dampier
1 Sea mile (1.85km.)
COCOS ISLAND
CHART BASED ON SURVEY, 1895

Map © Harold T. Wilkins

The "Islander" has been the subject for conversation among contractors and salvage men of the Pacific coast for many years. Seventy-two lives of the 145 persons aboard were lost when the ill-fated ship struck an iceberg and went down in five

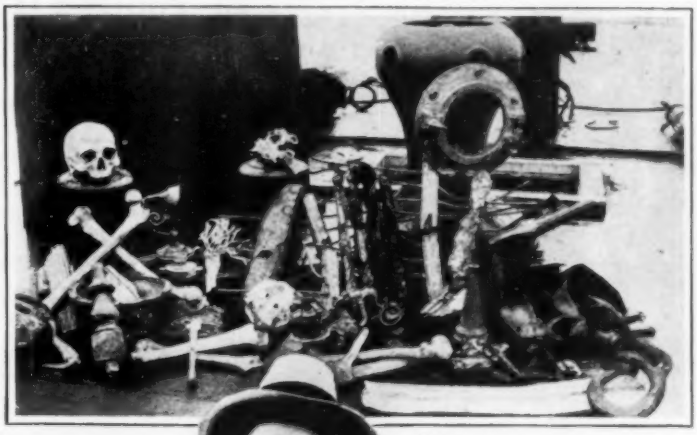


The Mobile Submarine Diving Bell, Built to Travel under Its Own Electric Power, Supplied by Cable, Equipped with Lights and a Crane, to Be Used in Searching the Treasure Ship "Islander"

minutes more than twenty-nine years ago. The gold was being shipped at the time of the gold-rush excitement in Alaska and the Klondike territory.

While this treasure hunt is going forward, attention is also being devoted to new expeditions seeking to recover the pirate gold believed to be buried on Cocos island. This little desert island, hardly more than six miles square, 550 miles southwest of the Panama canal, and a rendezvous of buccaneers and pirates since the days of Wafer, Davis and Dampier, and probably of much earlier English and Spanish adventurers, still draws men and women of many different types.

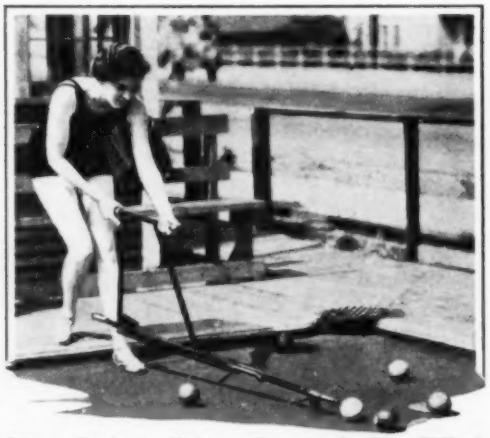
An ex-British admiral, an English lord, hard-headed



© Orowry
Reconnoitering Divers brought This Up from the "Islander"; at Left, the Ship's Bell, and Below, Frank and Roy Curtis, Leaders of the Expedition, Inspecting the Winches

New York and Frisco business men and financiers, scores of newspaper men, runaway seamen, shellback skippers, tramp-steamer captains, women of Newfoundland and the sturdy New England states, and a famous racing motorist, all have sought the stolen hoards hidden on this lone island, which is the verdant top of an extinct volcano in mid-Pacific. "One needs to go out to Cocos with a well-equipped, thoroughly seaworthy boat, accompanied by a few friends who are determined to put their backs into it," says Sir Malcolm Campbell, in his book "My Greatest Adventure", "and aided either by a strong, able-bodied crew or a gang of native workmen who can stand the heat."

Well known American scientists who in recent years have looked for the treasure include William Beebe, the oceanographer. Like so many others before and since, he tells a tale of dense tropical vegetation, sharks in the bays, landslides and impenetrable jungle.



Player Ready to Make a Shot on Outdoor Billiard Course; Note the Trigger Cue

BILLIARDS PLAYED IN OPEN AIR WITH TRIGGER CUES

Billiards has been moved outdoors where it is being played on a course as large as a dance floor but shaped like the conventional table. The balls are as large as oranges and are shot with cues that are operated with triggers and resemble small machine guns. The players stand on the big "table" and aim their cues.

CACTUS THAT HARBORS SNAKES KILLED BY COCHINEAL BUGS

Cochineal bugs have been imported into India for the purpose of destroying cactus clumps that harbor dangerous snakes. The insects can kill a cactus plant in about two months, after which the bugs breed rapidly. Cactus and cochineal both are native to America, and at one time the Aztecs raised cochineal on cactus for dyes. Later some European countries imported cactus for similar purposes, but in some cases with disastrous results. In both Australia and South Africa, it infested great grazing areas because its natural enemies were not present. One of these enemies is the cochineal bug. The insects breed about a generation a month and, on hatching, the "crawlers" wander over the plant until they find a favorable spot where they sink their tiny trunks into the cuticle of the plant and stay. It is believed the insects introduce a virus or bacterial disease into the plant. By killing the clumps of cactus in India, the bugs fight poisonous snakes as well.

COOLING JACKET FOR MILK CAN IS INFLATED WITH WATER

Evaporation of water from a burlap jacket keeps contents of a milk can cool, adding to the convenience of shipping perishable products that do not require extremely low temperatures, especially cream. The jacket fits snugly over the can. Because of the freedom permitted in handling the cans and to encourage their use, railways in the southwest have agreed to return the jackets to their points of origin without cost.

SLOW-MOTION BICYCLE KEEPS SHIP'S PASSENGERS FIT

Deck bicycles recently have been added to the gymnasium equipment of one steamship line as an aid in keeping the passengers fit by making available a healthful form of exercise on shipboard. These bicycles are not stationary affairs but can be ridden around the deck with safety. The chain attached to the drive sprocket, actuated, as on an ordinary wheel, by the pedals, is not geared to the rear wheel but to small auxiliary wheels, one at each side of the rear wheel. Although the same amount of energy is necessary to operate the vehicle as is required to pedal an ordinary bicycle, the deck wheel is propelled very slowly.

Courtesy Hamburg-American Line

Bicycles for Use on Shipboard; the Auxiliary Wheels Slow Down Speed of the Vehicles

Bombing a Ship Tests Skill of Army Pilots

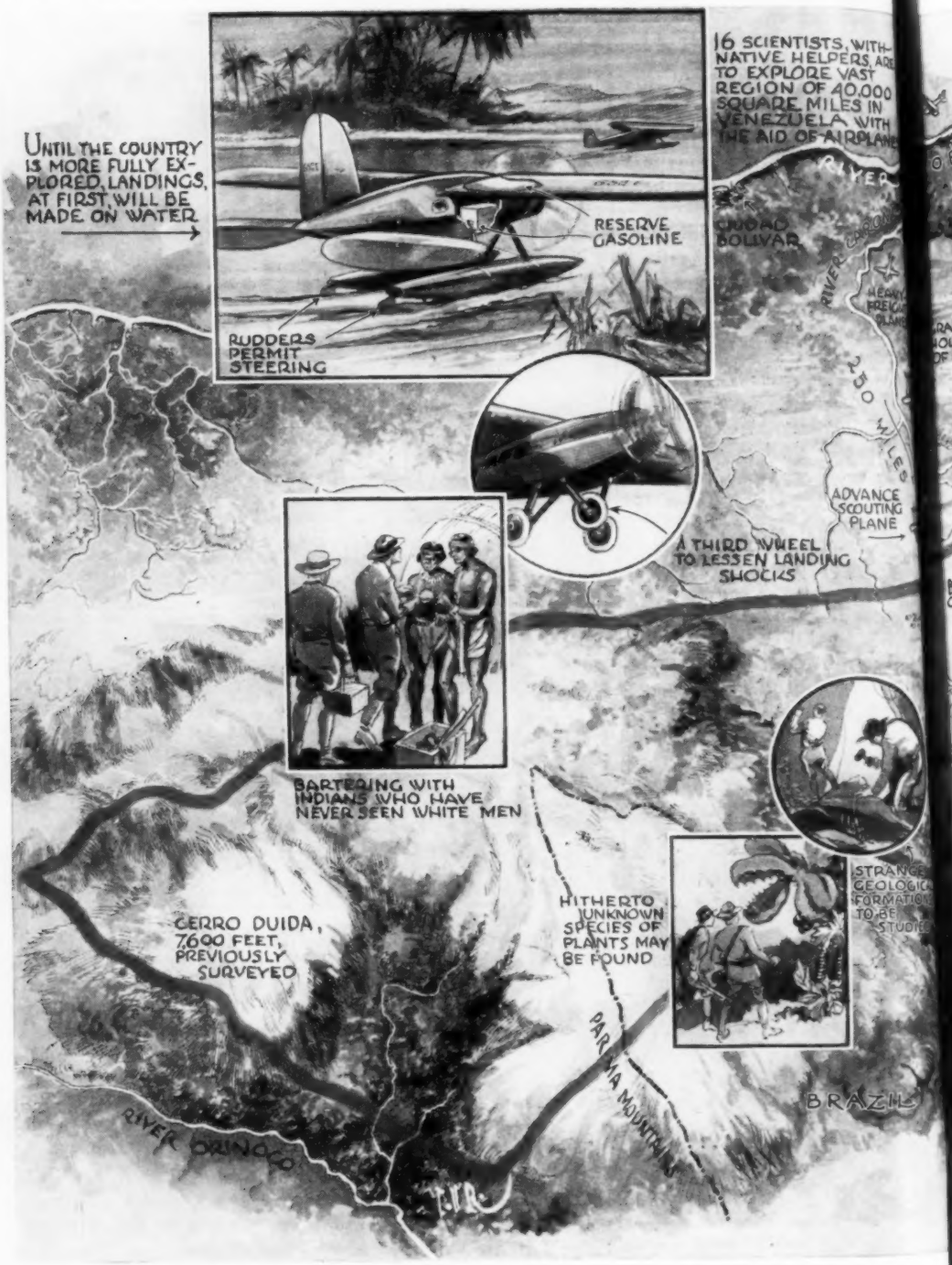
Scoring but two direct hits out of a series of bombs, army planes recently were forced to leave the completion of destruction of a derelict transport ship to the coast guard. Bad weather caused the tests to be postponed at the outset. One result of the tests, however, was the obtaining of some excellent photographs from the air, showing the target far below, tiny in the distance, the bomb on its way shortly after being released, and a second which shows the explosions as the bombs struck the water.

Top to Bottom, with Hand on Lever Ready to Release a Bomb; Missile in Mid-Air, and Exploding Bombs near Target

TEETH ARE INDEX TO BRAINS NEW THEORY

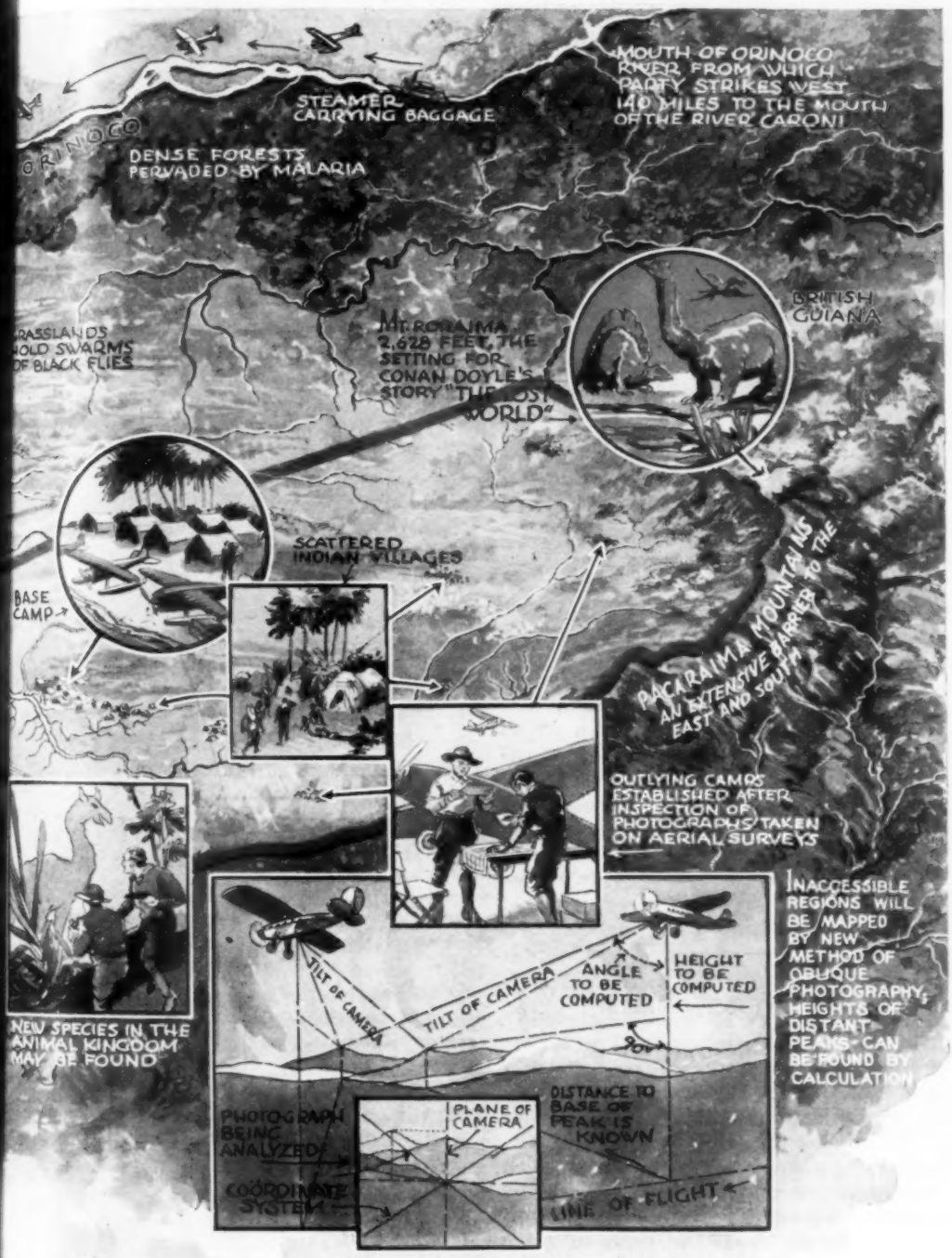
While brains grow, teeth rest, and man pays with weak and crooked teeth for a better brain. This is the view of Dr. G. Elliot Smith, professor of anatomy at a British college. During the first seven years of a child's life, he explained, there is a remarkable mental growth and a pause in dental development. For another fifteen years or so, he is sluggish in dental affairs because he is busy adjusting his complicated cerebral apparatus to life's needs, the delay in teeth and jaw development being due to these changes. But while brains are responsible for ugly teeth in man, they have given him a beautiful chin, his distinguishing mark in the animal kingdom. Doctor Smith believes that the part of the chin that does not bear teeth develops while the rest is held up and the salient chin, therefore, is an index of mental development. He does not say, however, that persons with the most prominent chins or the most outstanding teeth have the greatest brains. He also says there is no justification for the common belief that the smallness or absence of the third molar indicates that man eventually will lose that tooth. Apes, monkeys and the earliest man of which there is any record also had small third molars. Apart from changes resulting from racial mixtures, no developments are taking place to indicate such a radical alteration in human jaws or teeth, and nothing is to be expected, he declares.

Flying Explorers to Search the "Lost World" for


UNTIL THE COUNTRY IS MORE FULLY EXPLORED, LANDINGS, AT FIRST, WILL BE MADE ON WATER
RESERVE GASOLINE
RUDDERS PERMIT STEERING
16 SCIENTISTS, WITH NATIVE HELPERS, ARE TO EXPLORE VAST REGION OF 40,000 SQUARE MILES IN VENEZUELA WITH THE AID OF AIRPLANE
CIUDAD BOLIVAR
250 MILES
ADVANCE SCOUTING PLANE
A THIRD WHEEL TO LESSEN LANDING SHOCKS
BASE CAMP
BARTERING WITH INDIANS WHO HAVE NEVER SEEN WHITE MEN
CERRO DUIDA, 7,600 FEET, PREVIOUSLY SURVEYED
HITHERTO UNKNOWN SPECIES OF PLANTS MAY BE FOUND
PARIMA MOUNTAINS
BRAZIL
RIVER ORINOCO

Sixteen Explorers of the American Museum of Natural History Plan to Start Soon to Study the "Lost World" Region of Venezuela; Mountains and Forests Have Made It Impassable

for Cannibal Plants and Prehistoric Beasts


STEAMER CARRYING BAGGAGE
MOUTH OF ORINOCO RIVER FROM WHICH PARTY STRIKES WEST 140 MILES TO THE MOUTH OF THE RIVER CARONI
DENSE FORESTS PERVADED BY MALARIA
BRITISH GUIANA
GRASSLANDS HOLD SWARMS OF BLACK FLIES
MT. ROTAIMA 2,628 FEET, THE SETTING FOR CONAN DOYLE'S STORY "THE LOST WORLD"
SCATTERED INDIAN VILLAGES
BASE CAMP
PACARAIMA MOUNTAINS AN EXTENSIVE BARRIER TO THE EAST AND SOUTH
OUTLYING CAMPS ESTABLISHED AFTER INSPECTION OF PHOTOGRAPHS TAKEN ON AERIAL SURVEYS
INACCESSIBLE REGIONS WILL BE MAPPED BY NEW METHOD OF OBLIQUE PHOTOGRAPHY. HEIGHTS OF DISTANT PEAKS CAN BE FOUND BY CALCULATION
NEW SPECIES IN THE ANIMAL KINGDOM MAY BE FOUND
TILT OF CAMERA
TILT OF CAMERA
ANGLE TO BE COMPUTED
HEIGHT TO BE COMPUTED
PHOTOGRAPH BEING ANALYZED
COORDINATE SYSTEM
PLANE OF CAMERA
DISTANCE TO BASE OF PEAK IS KNOWN
LINE OF FLIGHT

Surveys from the Air Will Be Made of the Country, Most of Which Has Never Been Seen by White Men; Entirely New Plant and Animal Life Is Expected to Be Encountered

FREE WHEELING FOR SCOOTER WITH COASTER PEDAL

Free-Wheeling Scooter with Pedal Operating a Ratchet Device Which Permits Coasting

Free wheeling, the principle which allows an automobile to coast when the foot is removed from the accelerator, is imitated in a scooter for children which contains a pedal operating a ratchet device to permit coasting. Downward pushes on the pedal supply the motive power, each push sending the wheels forward three feet. Steering from an upright lever is applied to the two rear wheels and a small brake is installed just behind the front wheel.

NEON LIGHT RAYS CARRY SOUND ON NARROW BEAM

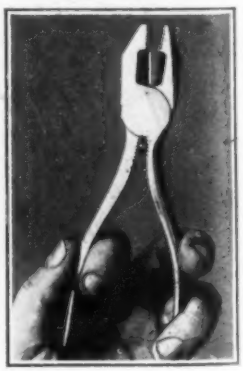
Light waves from a powerful neon tube are used to transmit sound on a straight line in experiments which seek to perfect a directional "narrow-casting" form of communication. The term narrow-casting refers to the narrow beam on which the sound travels, as compared with the broad beam employed in radio communication. Beams from the neon tube are actuated by electrical vibrations generated by microphone, phonograph and radio receiver, then transformed into exceedingly short light waves and focused on the distant receiver by a concave mirror mounted on a tripod. This receiver picks up the single narrow beam, and the electrical vibrations are turned into music or words. The narrow beam can be seen by observers at the receiving end, but cannot be intercepted except by an object interposed in the line of sight. Static does not interfere with this medium of communication, which holds possibilities of secret, direct communication between ships in harbor, within sight of each other, or between ship and shore.

FOUR-IN-ONE FRUIT IS FOUND IN SECTION OF ECUADOR

Combining the characteristics of an orange, peach, lime and tomato, a four-in-one fruit that is almost a salad in itself has been found in one small area of Ecuador by a research worker for the Academy of Natural Sciences of Philadelphia. This fruit was found in its wild state on a ranch near Banos. It is like an orange in shape and size, but has a thinner skin covered with a heavy peachlike fuzz. Its juicy pulp is filled with seeds like a tomato, while the skin is green with red veins, and the pulp is a vivid green. The fruit is edible and the juice forms the base for a refreshing drink, which already has found favor in the cafes of Quito.

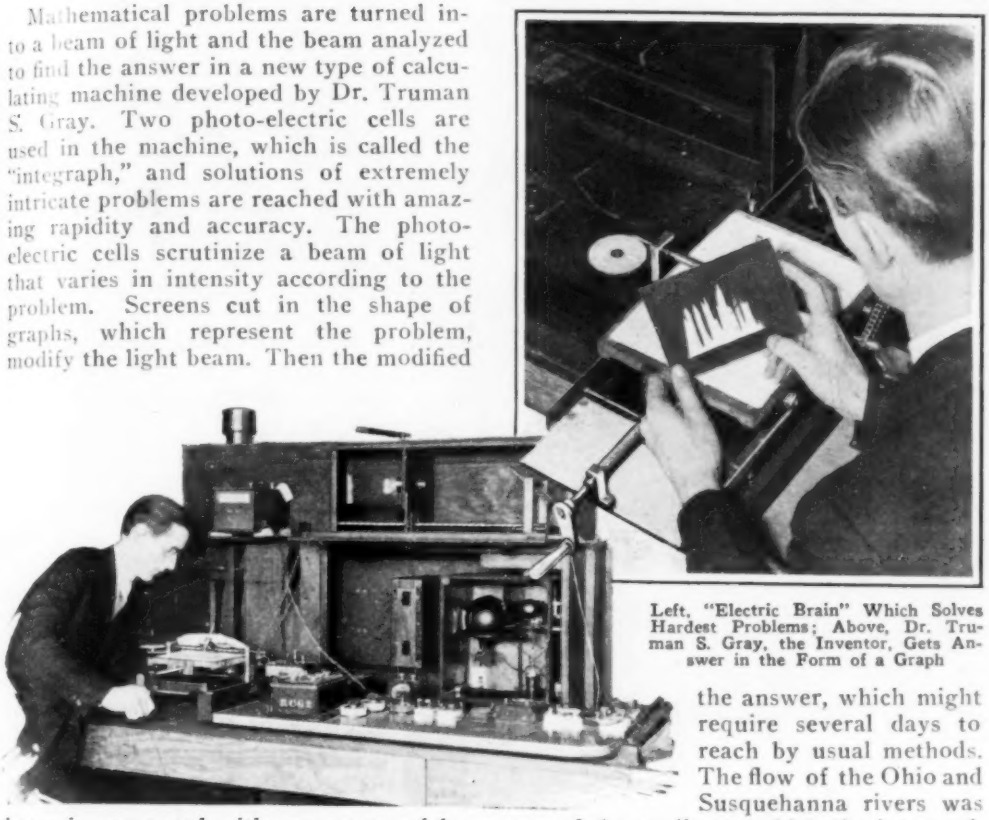
PLIERS TO REMOVE INSULATION HAVE MILLED HANDLES

Removing the heavy insulation from outside wire is made a simple task with a pair of pliers having a milled surface on the inside of the handles, just back of the joint. With this tool it is easy to remove insulation from wire without damaging the wire itself, and in addition the method will be found much safer than doing the job with a knife and quicker than trying to do it with ordinary pliers.



Electric Brain Solves the Hardest Problems

Mathematical problems are turned into a beam of light and the beam analyzed to find the answer in a new type of calculating machine developed by Dr. Truman S. Gray. Two photo-electric cells are used in the machine, which is called the "integraph," and solutions of extremely intricate problems are reached with amazing rapidity and accuracy. The photo-electric cells scrutinize a beam of light that varies in intensity according to the problem. Screens cut in the shape of graphs, which represent the problem, modify the light beam. Then the modified beam is compared with, or measured by, a beam of known quantity, resulting in the answer, which might require several days to reach by usual methods. The flow of the Ohio and Susquehanna rivers was one of the studies to which the integraph was applied.



Left, "Electric Brain" Which Solves Hardest Problems; Above, Dr. Truman S. Gray, the Inventor, Gets Answer in the Form of a Graph

GERMS LIKE JEKYLL AND HYDE ARE BROUGHT TO LIGHT

Certainty that some germs have been living a double life and playing Dr. Jekyll and Mr. Hyde to the bewilderment of bacteriologists and physicians has been demonstrated by Dr. Arnold I. Kendall, of Northwestern University. Invisible, filterable bacteria have been grown into a visible form for microscopic study by Doctor Kendall, who points out that possibly the life of a germ resembles that of a butterfly, with the caterpillar, cocoon and butterfly stages. Bacteriologists now believe that one disease may be caused by the germ in its invisible form and an entirely different disease by the germ in the form studied under the microscope. Use of Doctor Kendall's discovery may be an aid in finding a cure for diseases hitherto believed incurable.

EARTHQUAKE MAY BE FORECAST BY TILT OF EARTH'S CRUST

If records can be made of the gradual tilt in the earth's crust before an earthquake, seismologists will advance another step in their efforts to forecast earthquakes, the Rev. Joseph Lynch, of Fordham University, says. That there is such a tilt already has been determined, and only a record of this is necessary to enable science to warn inhabitants in the zone where the quake is forming. In Germany, artificial quakes are created by explosives. By measurements obtained from recording instruments, the mineral content of the earth may be determined.

Aerial Tramway Which Carries Passengers into the Alps; It Makes an Ascent of Almost Two Miles

AERIAL CAR RISES TWO MILES ON ALPINE TRAMWAY

Starting from Vienna, an aerial tramway carries passengers on a two-hour ride into the Alps, the trip offering one of the most unusual journeys devised by man. Passengers in the aerial conveyance are carried to a height of 9,675 feet, or almost two miles, before they reach their destination.

PARACHUTES MADE OF COTTON MEET NAVY'S TESTS

Parachutes made of domestic cotton cloth have proved equal or superior to those of silk in strength and tear-resistance trials by the navy department. The cloth was woven in the bureau of standards mill and meets all requirements with respect to air permeability and weighs only slightly more than silk. The tests indicate that cotton parachutes closely approach those of silk in rate of descent, opening time, strength, and ability to function after being stored in the pack for sixty days.

ALUMINUM CLOTH MAKES RUSTPROOF SCREEN

Aluminum wire, closely woven to form a cloth for screening windows and doors, is on the market, offered as a rustproof material. It resists rain, wind, sun, salt water and corrosive fumes, eliminating the usual streaking of screens after exposure to the weather. A double wire reinforcement at the edge gives extra strength at the nailing line, where most tears occur in other screen wire. The aluminum cloth is easy to stretch, cut and nail, and requires no painting after years of use.

MACHINE GUN ON MOTOR CYCLE FOR CAVALRY

Cavalry troopers of the United States army are discarding their horses in favor of motorcycles, some of which now carry submachine guns mounted on the front. This step in mechanizing the cavalry increases its range of operations and effectiveness many times as compared with the horse era.

Motorcycle with a Sub-Machine Gun Mounted in Front Now Used by United States Cavalry

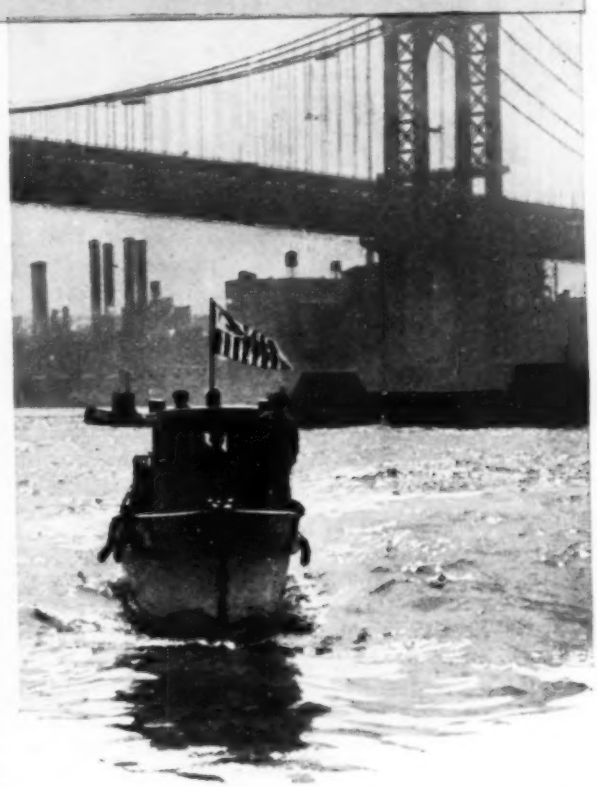
Mystery Men of the Sea

"I'D RATHER search six square blocks of houses than one lone freighter." It was Inspector Mike Russo of the custom service speaking. Dressed in denim overalls, with a face none too clean and a disreputable cap over one eye, he was well cast for the part he was to play, that of a longshoreman.

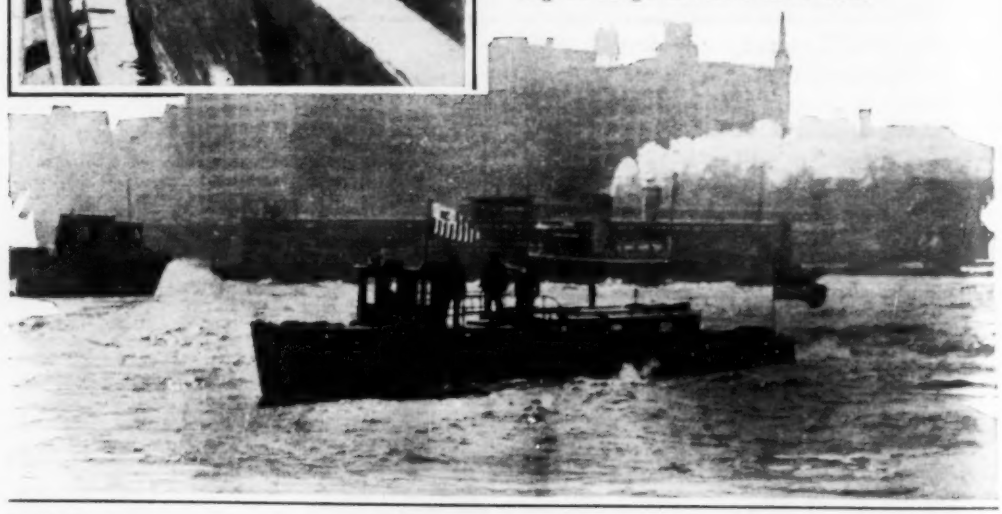
Only the slight bulge over the hip concealing a pistol, or a little plumpness where a badge was pinned inside the shirt marked him and his aides as the mystery men of the service, a highly trained special smuggling squad, thoroughly conversant with the traits of international smugglers of dope, Chinamen and liquor.

Methodically they go over a ship with the proverbial fine-tooth comb. And searching a ship is a tedious job with hundreds of seemingly inaccessible places to which the smugglers resort.

They are a fine body of men, these undercover men, taking all sorts of personal risks. Bullets



Searching Ship's Funnels for Narcotics, and Pacing the East River Beat in a Custom Boat on Patrol



Disguised as Stevedores, the Inspector and a Guard Look Over a Lighter, Above, and a Typical Custom Boat on the Hunt for Stowaways and Contraband, Below

are the least of the hazards they face; pneumonia and pleurisy the greatest. A man must have a constitution of iron to search a hot engine room and go out on deck immediately afterward to search a cold hatchway.

Recently these men were instrumental in exposing a ring of smugglers whose activities extended as far south as Buenos Aires. The story of that hunt is a story of Chinamen who were smuggled into New York.

From $500 to $1,000 was the price paid to the smuggling ring to bring them in. The story of the ring's operation, as told by Inspector Russo, may lead to charges of murder as well as smuggling. In many cases, it was said, the smugglers, employed as seamen, dropped some of their human cargo into the sea when capture seemed imminent.

The smugglers of aliens, like the rum runners, have their hijackers. A ring smuggling in one group of hatchet men was hijacked five times with loss of life, before agents of a rival ring succeeded in getting them aboard a ship.

Where, on board a ship, may a Chinaman be concealed? "In any number of places," says Inspector Russo, "ranging from the engine pit right on up to a ventilator on the top deck. And sometimes we don't get 'em out alive either. Starvation, suffocation and the sudden shifting of cargo all take their toll.

"One of the most ingenious smugglers I have caught had made quite a good thing of importing Chinamen in his stateroom. He hollowed out a bulkhead, placed a couch against it and thus provided a fine receptacle for a stowaway. He brought in one each trip until we got wise to him."

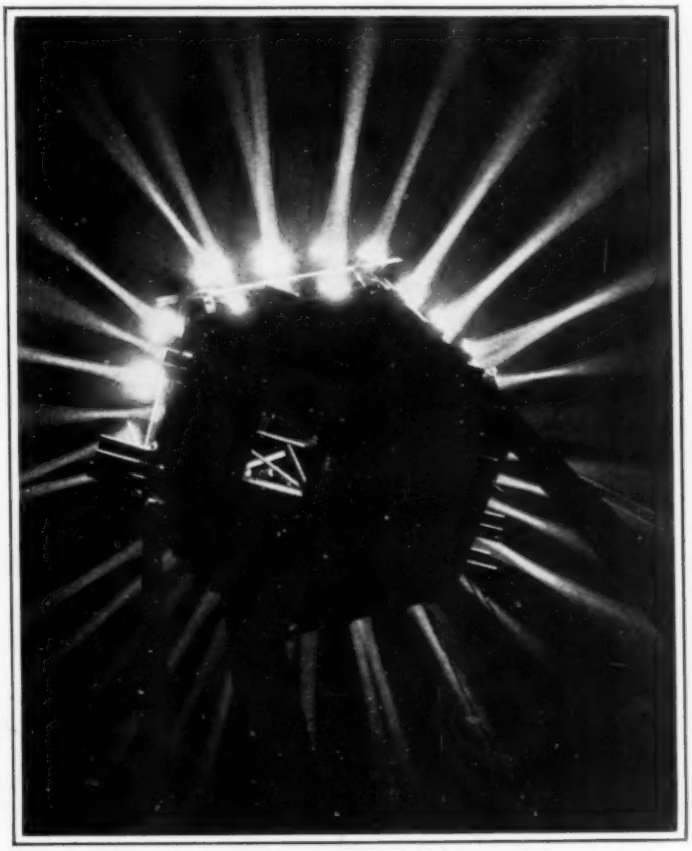
Most of the smugglers are found among members of a foreign ship's crew, scarcely ever among the officers. Either a

smuggler ships as a seaman or he may be approached by a member of an international ring after having honorably served aboard a ship for years.

The licensed "junkies" of the harbor, too, occasionally take a hand in running contraband ashore. Beneath their piles of old rope ends and junk, purchased or stolen from a near-by ship, they may conceal priceless contraband.

There is, however, just one method of smuggling that occasionally baffles the custom men. They admit it and soon expect to have a solution to the problem. Resourceful smugglers sometimes lower a heavy tank from the stern of the boat, burying it in the muddy river bottom while the vessel is being searched, and leaving, as the only clew, an innocent-looking line, which can haul the contraband ashore again when the coast is found clear.

The secret has been revealed, however, and the mystery men are now paying close attention to all such innocent-looking lines.



Tower of Light That Illuminates a Speedway Bowl at Los Angeles, Making It Possible to Hold Automobile Races at Night

ROSE THAT BLOOMS ALL YEAR GETS FIRST PLANT PATENT

Exclusive rights to reproduce, use or sell an ever-blooming rose for seventeen years have been assigned to a New Jersey nursery under the first plant patent granted at Washington since passage of the act in 1930. The patent covers a "climbing or trailing rose, the 'new dawn'," and the patentable feature is its ever-blooming character. The flower is described as being identical with the Dr. Van Fleet climbing rose, except that instead of blooming only once a year, it blossoms successively in the same manner as the ever-blooming tea roses.

TOWER LIGHTS UP SPEEDWAY FOR AUTO RACING

Huge bulbs, fastened atop a tower in the infield of a Los Angeles speedway and casting a flood of light over the area five-eighths of a mile around, recently were turned on, and a crowd saw thirty-five race drivers line up for a contest at night. It was one of the most spectacular races ever run, with the cars roaring around the oval at speeds greater than ninety miles an hour in the ghostly glare of millions of candlepower. The system is a development of lighting for night baseball.

¶Popular Mechanics Magazine does not publish the name of the maker or seller of any device described in its pages, but this information is kept on file and will be furnished free upon application to our Bureau of Information.

"Torture Wheel" through Which a Percentage of Each Type of Bulbs Made Must Pass Unscathed

"TORTURE WHEEL" FOR LAMPS MAKES THEM BETTER

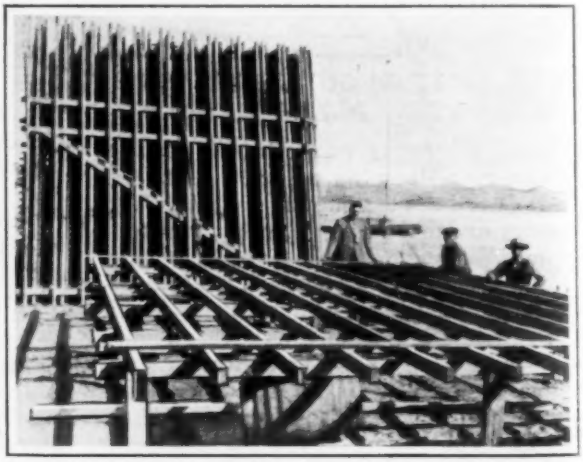
Putting all its predecessors to shame, a new form of testing apparatus has been developed by the General Electric company through which lamp bulbs must pass before they are declared fit for sale. Known as the "gravity impact tester," it might more properly be termed the "chamber of torture." A percentage of lamps of each new type turned out at the factory are put through the machine and subjected to a total of eighty falls from successively higher points. The apparatus is in the shape of a large wheel with shelves built in at graduated distances from the wheel's surface. As the wheel revolves, the bulb being tested falls from one shelf to another, each fall being greater than the preceding one. It is the culmination of a series of tests designed to find in the bulbs any weaknesses or faults which might become apparent as the result of shocks received in transportation.

IRON CONTRACTS AT HIGH HEAT AS ATOMS SHIFT PLACES

Iron expands under heat up to 1,650 degrees Fahrenheit, then it contracts, decreasing in length about two parts in a thousand. If the temperature is increased still more, the iron expands regularly, though at a different rate. When the hot iron is cooled, the process is reversed, the decrease of contraction taking place until the iron has cooled to 1,650 degrees. Then it expands suddenly, but on further cooling, continues to contract. Rearrangement of the iron atoms at this one point in the heat range is the explanation given by metallurgists after studying the strange process by X-ray.

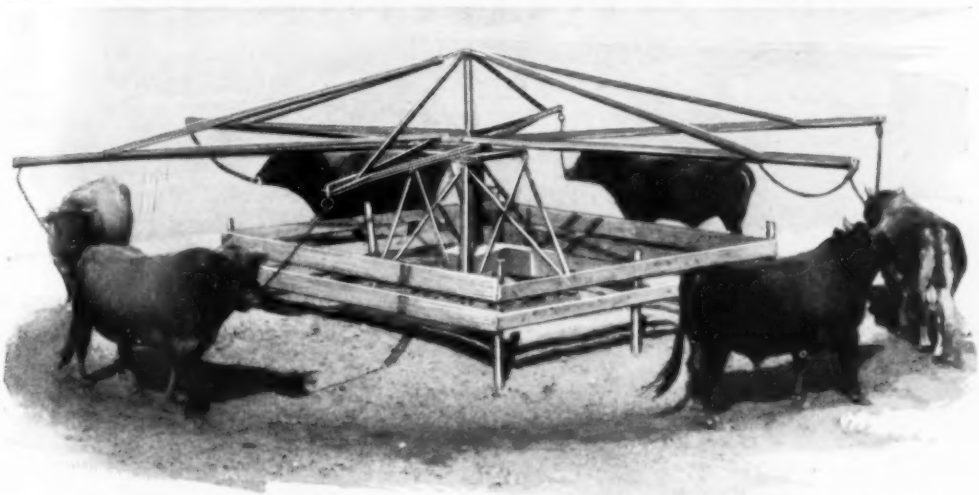
OYSTERS HANGING FROM RAFTS GROW FASTER

Oysters grow much faster and in far greater quantities under a patented process, known as the shellfish-setting apparatus, which is being employed on the California coast after long tests in Japan. The method revolutionizes orthodox practices, which call for raising the oyster on the bed of inlets. Under the Japanese method, the oyster is suspended on specially prepared ropes hanging from a floating raft. The raft may be towed from place to place, to take full advantage of weather and tide.



Rafts from Which Young Oysters Will Be Suspended on Ropes under a Patented Method of Shellfish Raising

Merry-Go-Round for Cattle Keeps Stock Fit



Motor-Driven Merry-Go-Round for Exercising Cattle; the Steel Arms of the Exerciser Lead Half a Dozen Animals at a Time, and the Stock Seem to Enjoy the Experience

Pedigreed stock of one eastern cattle fancier have their own exercising machine in the form of a merry-go-round to keep them fit. After the owner had found that hiring men to lead costly cattle around a paddock was both expensive and dangerous, he solved the problem by making an electric motor-driven merry-go-round, the steel arms of which lead half a dozen animals at a time around in a circle. The blooded stock seem to enjoy the experience, once they become used to it.

NEW USES FOR COTTON SEEN WITH LARGER CROPS

Increased production of cotton plants for the extraction of cellulose, used in making rayon and paper, is being sought at a number of experimental farm stations. Several types of cultivation are being tested to find the one which will produce plants with the most cellulose. It has been found already that, if the plant yield per acre can be increased to about twice the amount produced under customary methods, cotton could in all probability compete successfully with wood pulp as a source of rayon. Experimenters believe that a gross yield of 5,000 pounds of cotton plants per acre can be obtained from good soil. This would be mown mechanically, baled, and either ginned in the mass or put directly through the chemical processes for extraction of the cellulose, both from the lint and the plant. Oil in the seeds is recovered chemically.

ELECTRIC CLOCK AIDS BUSINESS WHILE IT TELLS TIME

For the store, bank or office, an electric clock is being offered that talks business while it tells time. Below the face is a space in which may be inserted half a dozen cards in colors, each bearing an advertising message. These cards are changed automatically at the rate of one each ten seconds by the same impulses that operate the clock. Cards can be replaced without difficulty, and a reflector to give a spotlight effect to the card space can also be obtained. The clock has an eleven-inch dial.

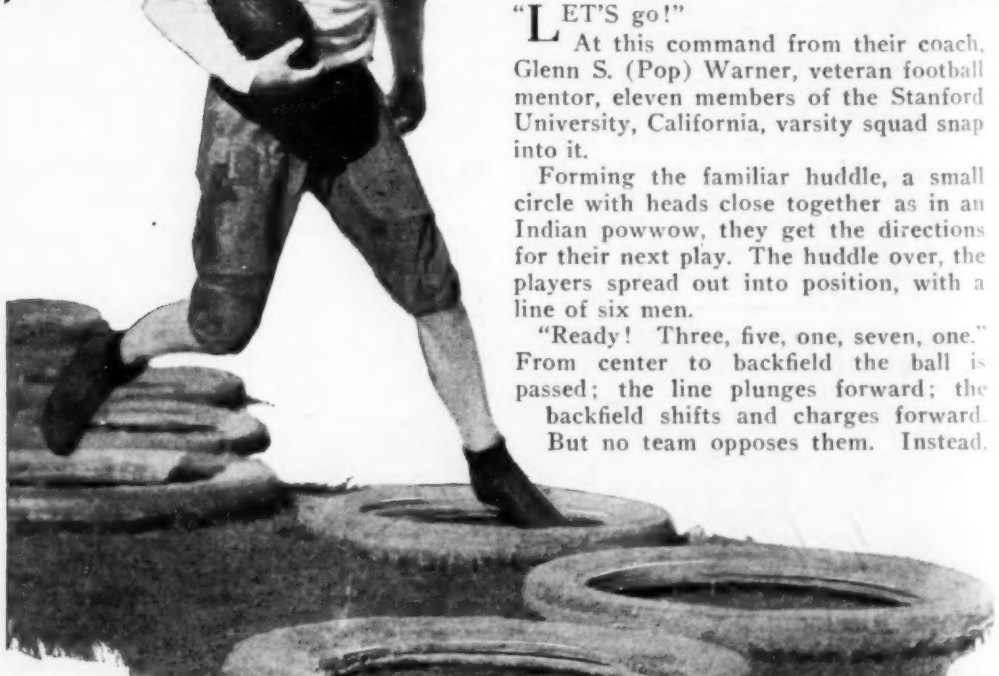
Only Dummies – *but*

"LET'S go!"

At this command from their coach, Glenn S. (Pop) Warner, veteran football mentor, eleven members of the Stanford University, California, varsity squad snap into it.

Forming the familiar huddle, a small circle with heads close together as in an Indian powwow, they get the directions for their next play. The huddle over, the players spread out into position, with a line of six men.

"Ready! Three, five, one, seven, one." From center to backfield the ball is passed; the line plunges forward; the backfield shifts and charges forward. But no team opposes them. Instead,



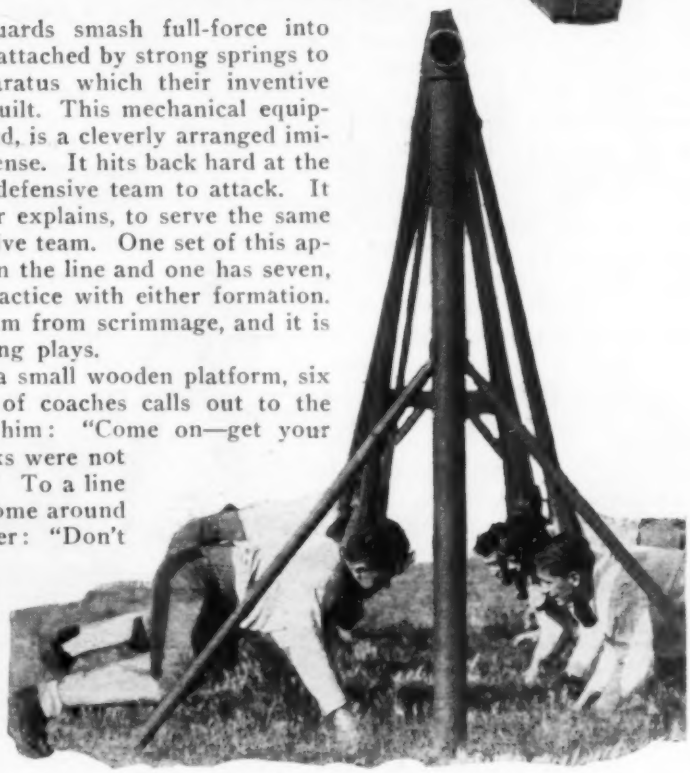
Athletes Developing Shoulders on Charging Sled; Below, Tires on the Field Teach Dodging

they Hit Back HARD

the ends, tackles and guards smash full-force into heavy dummies which are attached by strong springs to a unique scrimmage apparatus which their inventive coach has designed and built. This mechanical equipment, which is not patented, is a cleverly arranged imitation of an imaginary defense. It hits back hard at the players. It gives them a defensive team to attack. It was invented, Pop Warner explains, to serve the same useful purpose as a defensive team. One set of this apparatus has six dummies in the line and one has seven, to provide facilities for practice with either formation. Its use saves an entire team from scrimmage, and it is a decided asset in analyzing plays.

From his position atop a small wooden platform, six feet in height, this dean of coaches calls out to the squad down in front of him: "Come on—get your think-tanks on! You backs were not close enough to the line!" To a line player: "And you didn't come around far enough." To another: "Don't you know you are a guard? Now the same play again!"

Then follows another huddle, lineup, calling of signals, and charge through and around the imaginary team. And those dummies hit back



Swinging Charging Apparatus to Develop Timing

hard, thanks to Warner's inventiveness in arranging them on hooks with a heavy spring at the bottom.

To develop strength and alertness, Warner has invented a charging apparatus. That's what he calls it, but the players refer to it as the "crack-in-the-jaw machine." A round steel bar, about fifteen feet in length, is set up on steel posts. From this bar are suspended four sets of two boards. These planks, a foot in width and about eight feet long, are clamped together at the top, but spread a couple of feet apart at the bottom. Here they are heavily padded and covered with canvas. They swing back and forth. The idea is that four players charge the planks from one side and four from the opposite side at a given signal. Those who are a moment late are likely to get the full force of the padded plank as it is pushed toward them by their opponents. Additional training on this charging apparatus involves crouching on hands and feet (but not knees) and pushing with the shoulder, while, on the opposite side, a fellow player is also pushing.

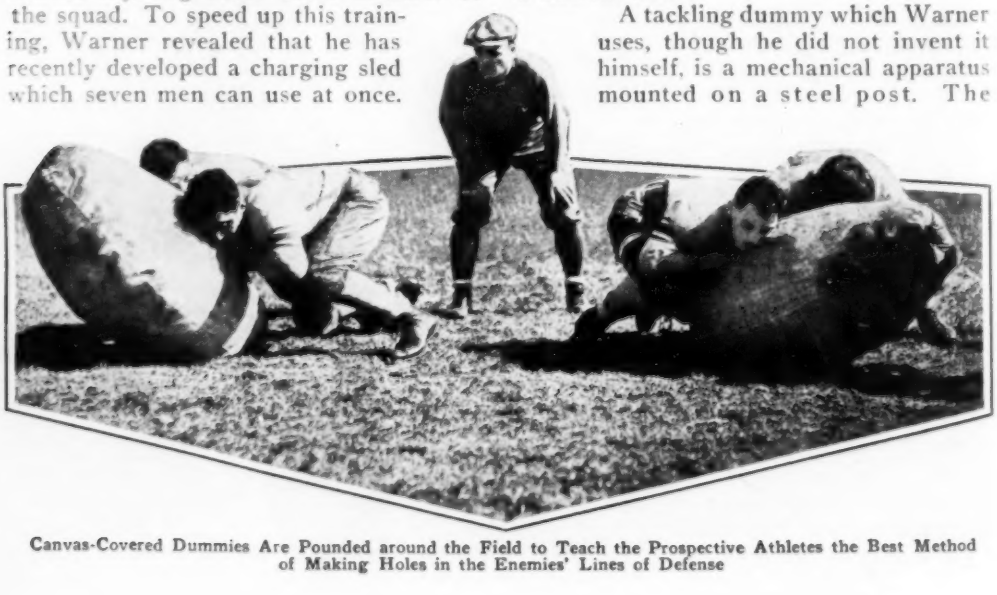
Warner has also invented a charging sled. This is a plank, heavily padded at the base and hung from a wooden framework, which is built on a base that gives it the name of "sled." The player rushes at this and strikes the plank with the shoulder and gets useful training without risk of injuring some other member of the squad. To speed up this training, Warner revealed that he has recently developed a charging sled which seven men can use at once. This aids in comparisons, too. Linemen use the sled to develop shoulders and legs and ability to charge, and backfield men use it for leg exercise.

One of the handicaps coaches meet in trying to show a large group of men some detail of play is that they must crowd too close to the squad on the field, if they are to get a clear view of what is going on. This problem puzzled Warner a while, and so he invented a portable grandstand. This is moved readily about on rollers to any point on the field.

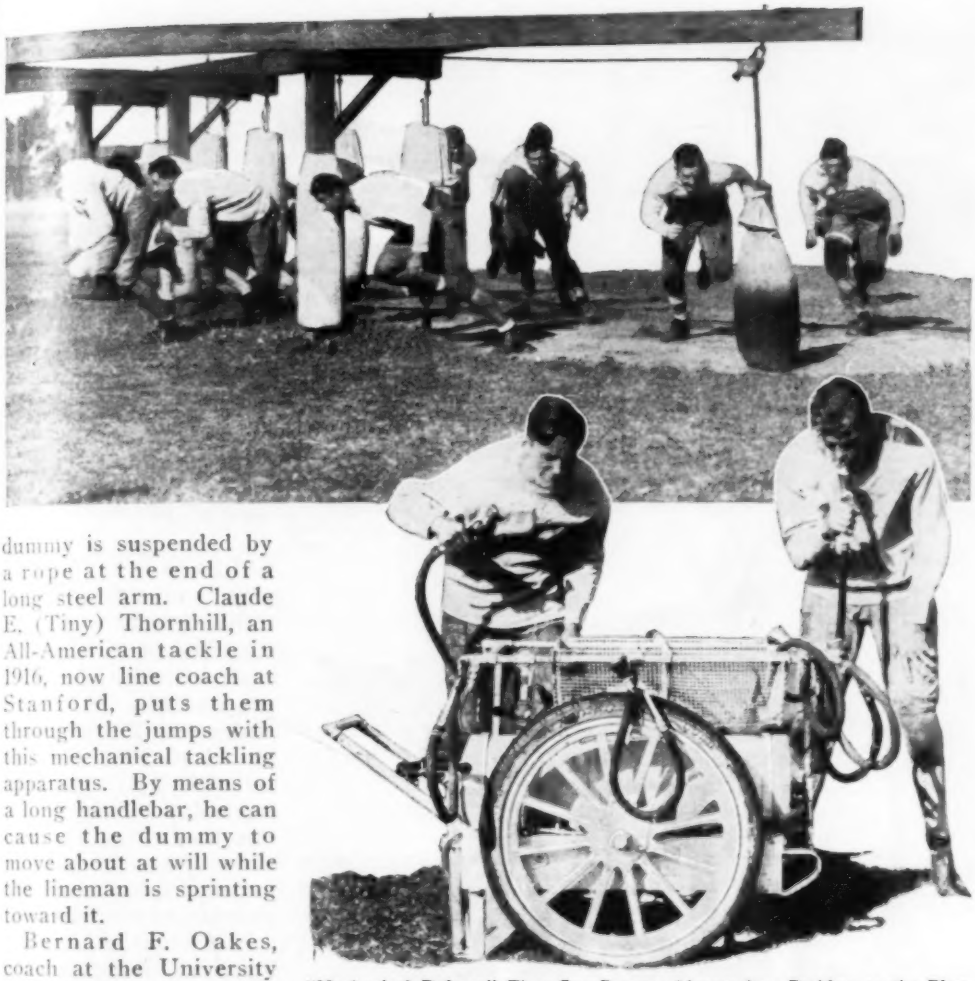
To aid in teaching the backfield men how to develop a sidestep, Pop Warner has old automobile tires strewn around flat on the ground, and the men must speed through them as they carry the ball. As they are placed without any order, the backfield man must think fast as he shifts from left to right in running.

One of the problems of a coach during a game is to see that the players do not drink water when they "sponge off" the face and head during time out. To keep fit, they are forbidden to eat or drink during a game. One day recently there appeared on the training field at Stanford an odd-looking rubber-tired water wagon. This is a tank on wheels with six short hose having nozzles at the end. Now six players at a time can spray the head and face and yet cannot drink the water because the stream is adjusted to issue as a fine shower.

A tackling dummy which Warner uses, though he did not invent it himself, is a mechanical apparatus mounted on a steel post. The



Canvas-Covered Dummies Are Pounded around the Field to Teach the Prospective Athletes the Best Method of Making Holes in the Enemies' Lines of Defense



"Mechanical Defense" That Can Present Almost Any Problem to the Players the Operator Wills; Below, the Shower Wagon

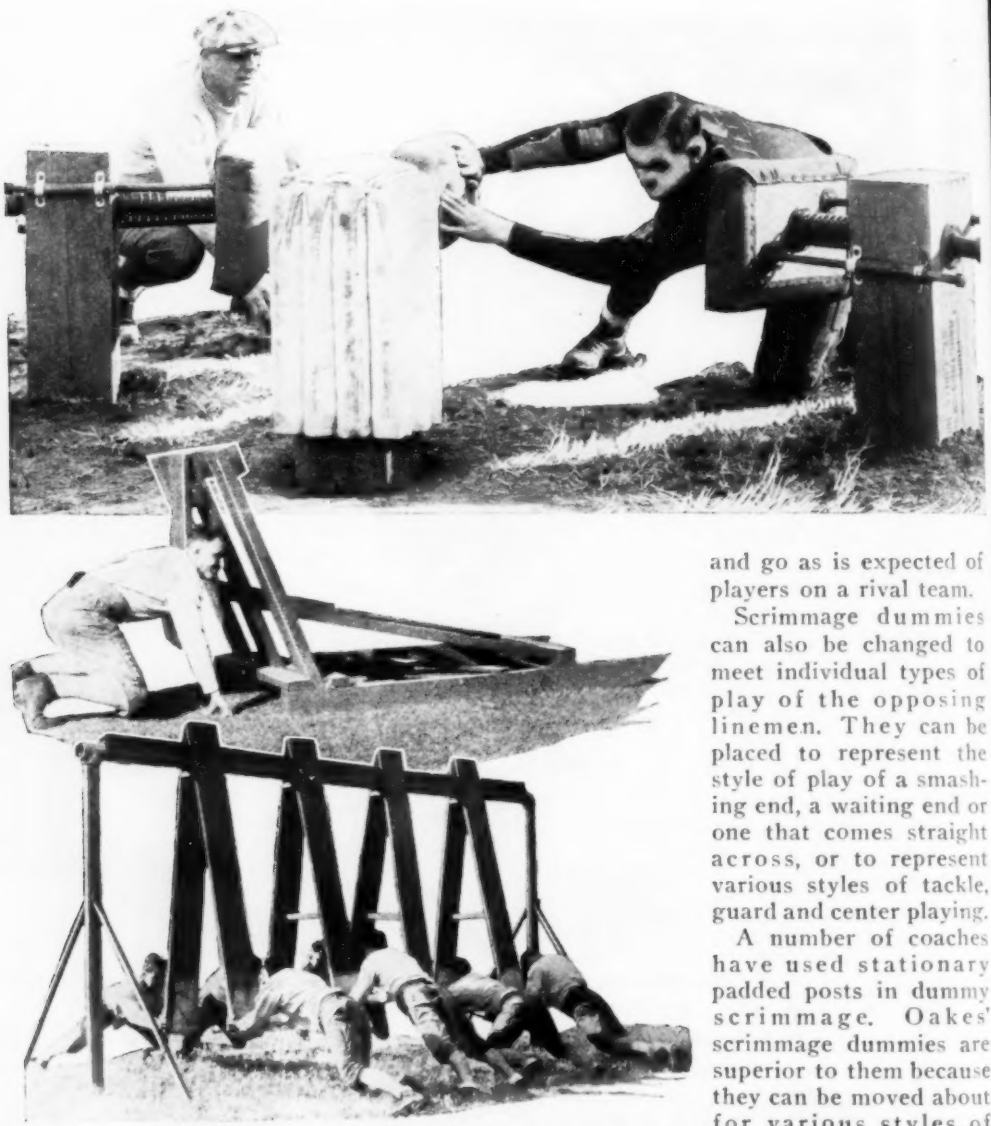
dummy is suspended by a rope at the end of a long steel arm. Claude E. (Tiny) Thornhill, an All-American tackle in 1916, now line coach at Stanford, puts them through the jumps with this mechanical tackling apparatus. By means of a long handlebar, he can cause the dummy to move about at will while the lineman is sprinting toward it.

Bernard F. Oakes, coach at the University of Nebraska, is another inventor of machines to save time and reduce wasted gridiron energy. The modern tendency in football is to curtail scrimmage sessions and to shorten all practice periods. That makes it necessary to introduce speed and efficiency into coaching methods.

Two years ago, Oakes developed his first invention, a football charging machine, which is now employed by several universities. It is used for teaching the fundamentals of defensive line play. This machine consists of three padded bumpers which represent three opposing linemen. The two outside bumpers each represent the shoulder or sides of two charging offensive linemen, and the center bumper, the head and shoulders of the middle offensive lineman. Defensive players work against this machine to develop the knack of charging through the opposing line, using their hands and developing co-ordination and quick action.

Oakes' latest invention was first used in the 1930 football practices and is employed principally in teaching the fundamentals of offensive play. It consists of scrimmage dummies which are anchored to wooden bases by "back springs." These springs cause the dummies, after they have been hit from any direction, to rebound to an upright position like a roly-poly.

They are used in practicing blocking and in perfecting the timing of plays. The dummies can be arranged to resemble the style of play expected of opposing line-



The Charging Machine in Action, Above; One-Man Sled in the Center, and Below, the "Crack-in-the-Jaw" Machine

men. If the team is preparing to play a game with opponents who use a six-man line, the dummies are arranged accordingly, and the linemen can practice blocking out the linemen of the defensive team.

Coaches also use four dummies to represent the four backfield men, but these are not fastened to any base and can be knocked down. The scrimmage dummies on the line will not be knocked down. They exhibit the same tenacity to get up and go as is expected of players on a rival team.

Scrimmage dummies can also be changed to meet individual types of play of the opposing linemen. They can be placed to represent the style of play of a smashing end, a waiting end or one that comes straight across, or to represent various styles of tackle, guard and center playing.

A number of coaches have used stationary padded posts in dummy scrimmage. Oakes' scrimmage dummies are superior to them because they can be moved about for various styles of play, and linemen can hit them with any degree of fury without risking injury.

Scrimmage dummies are effective savers of time because they do away with the old kind in which second and third team players take the parts of opposing linemen. By using these dummies, coaches can run two or three teams through the plays consecutively.

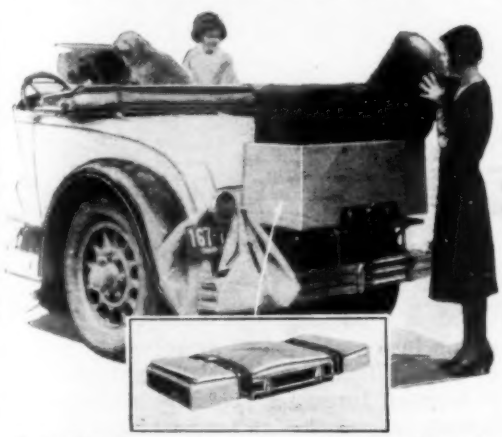
The old-fashioned tackling dummy is still used by all football coaches in teaching fundamentals, and the charging sled is in general use by most line coaches.

But they do not produce the realistic effect of Oakes' inventions because they will not recoil after being hit. Oakes' machines are like robot football players which react to any charge much in the same way as real players.

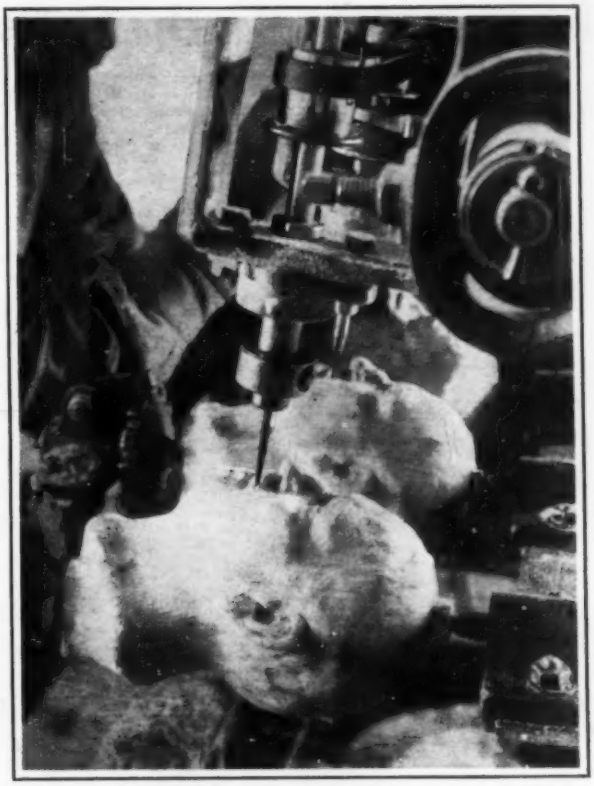
Coach Oakes is a firm believer in the value of machines in coaching football players, particularly in line play. He believes machines save time, reduce injuries, and, in some instances, are more effective than actual scrimmage, although he admits some scrimmage is necessary.

COLLAPSING AUTO TRUNK FITS ON LUGGAGE RACK OR RUNNING BOARD

Protection for baggage from dust and rain at moderate cost is afforded by a collapsible fabric trunk that can be fitted to any luggage rack or on the running board of the automobile. It can be adjusted to the size of the baggage and is made of double-texture fabric with rubber center, fitted to a steel frame. The top fits over the cover and is tightened with strap fasteners. The carrier can be obtained with a rack provided with hooks to which it is attached, or it can be fitted to any standard rack or on the running board by means of a special base for this purpose. When not in use, it is folded.



Collapsible Fabric Trunk That Fits Any Luggage Rack or Rests on the Auto Running Board



Using an Automatic Wood-Carving Machine to Turn Out Statuettes, Six at a Time, from One Original

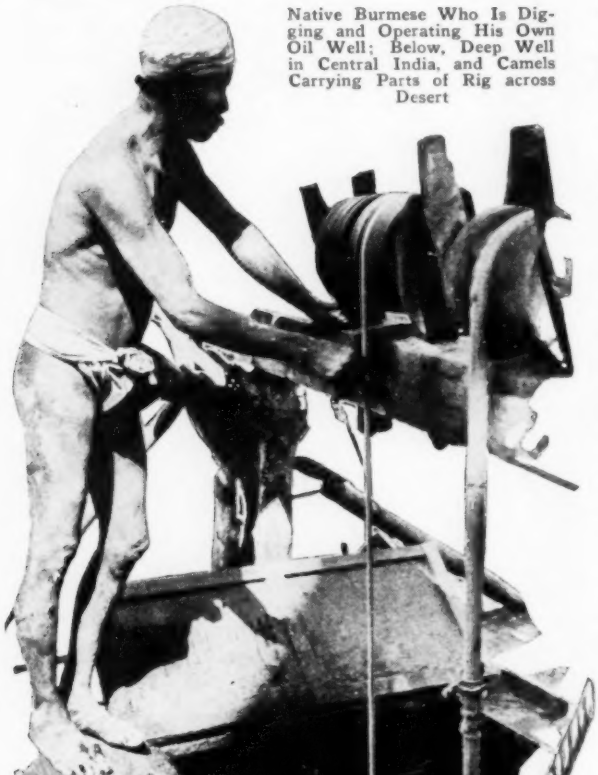
SIX STATUES CUT AT ONE TIME BY MULTIPLE WOOD CARVER

Wooden statuettes now can be turned out, six at a time, from an original pattern through the use of an automatic wood-carving machine invented in Germany. After the original model has been made, it is placed in the cradle of the carver, the tools are adjusted to the six blocks of wood and the machine does the rest, cutting six noses or six ears at once.

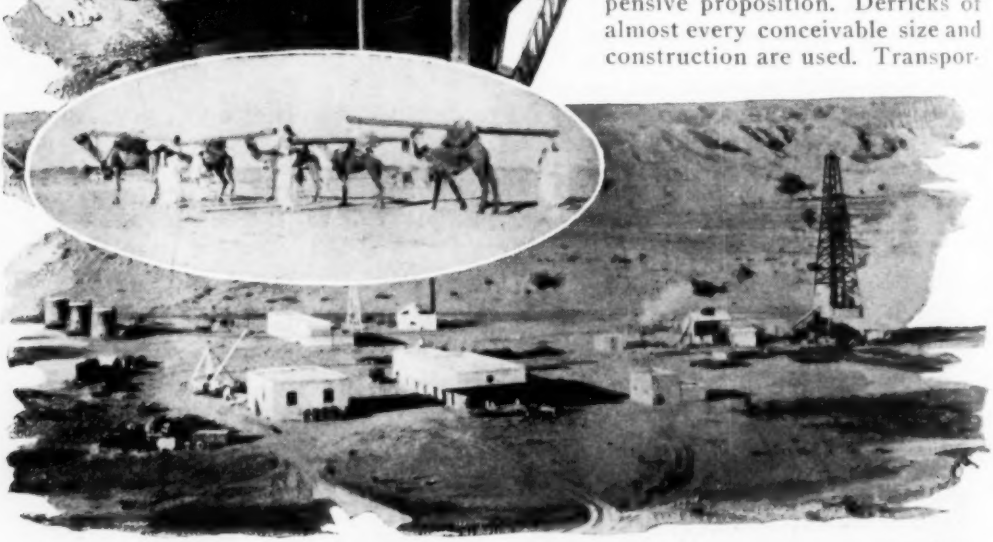
SEA WHIRLPOOL REPELS SHIPS BY SPINNING OUTWARD

Strong enough to repel a ship, a whirlpool that spins from the center outward has been found 150 miles east of Cape Cod in the Atlantic. Capt. William E. Parker reported that he failed on several attempts to force one of the coast and geodetic survey vessels through the whirlpool, the force of the water throwing him off his course.

Romance in World Quest for Black Gold



Native Burmese Who Is Digging and Operating His Own Oil Well; Below, Deep Well in Central India, and Camels Carrying Parts of Rig across Desert



The search for oil is world-wide. Conditions of the oil market may delay or slow up some operations, but still the drilling goes on in a never-ending exploration for hidden pools. Difficulties arise that try the experience of the oldest drillers, but they usually have a trick to overcome any kind of trouble, even in out of the way places of the world. In sinking the holes, the casing may buckle and have to be pulled up or a defective section taken out and rerun. Sometimes it is even necessary to drill up a piece of steel casing to get past it when it cannot be pulled from the hole. American crews have drilled in Lake Maracaibo, Venezuela, where piers, barges and tugs were part of the required equipment. They have gone into the wilds of Borneo forests; worked on burning deserts in India, drilled in Santo Domingo; explored the Holy Lands of Palestine and completed wells in Peru, Ecuador, Mexico, Algeria, Canada, Portuguese East Africa, Rumania, Russia, Persia, and many other places in the far corners of the world. Turning a tropical wilderness into a modern oil camp is an expensive proposition. Derricks of almost every conceivable size and construction are used. Transportation into a wilderness or across a desert or swamp land is a laborious matter. In a Borneo forest, a primitive three-pole derrick was used with an American-made diamond-bit core-drilling outfit. The

smokestack of a boiler on a drilling outfit in India was blown away by a tropical hurricane. There was none to be secured within hundreds of miles of the location. The driller glanced at some steel oil barrels and quickly started some workmen knocking the tops and bottoms out of them. Then the barrels were welded together and a very efficient smokestack made with only a day's delay. When the difficulties of sinking a hole have been overcome and the well approaches the desired depth—then comes the climax. The well may be a duster—as dry as a dust storm on a Kansas prairie. Granite and salt water are two of the most dreaded finishes to a well. Granite means that all efforts are futile. But when a new field is discovered that is a heavy producer, the rewards are so great that all discouragements are forgotten.

SHOOT WITH BOTH EYES OPEN IS ORDER TO SOLDIERS

Training regulations now in force in the army teach the pistol or revolver marksman to shoot with both eyes open, instead of closing one eye and aiming with the other. The rule was promulgated to enable a soldier to see an enemy approaching from his left while he is in the act of firing. The method also is of value to mounted men who must keep their horses under control while they shoot.

SPRING KEYS FOR TYPEWRITER LIKE SHOCK ABSORBERS

Spring keys which are resilient to the finger touch and at the same time add impetus to the type bar, recently were placed on the market as a typewriting comfort feature. The keys are made to fit over the pads on any standard machine. A coil spring inside the key absorbs the jars and gives a reactive pressure on the type. The letter is inlaid so that it will always remain clear and bright.

Stilts with Footrests That Run in Slots and Are Adjustable to Size of User

HEIGHT OF STILTS ADJUSTABLE TO SIZE OF THE USER

Stilts that are adjustable in height to the size of the boy using them have footrests which run in slots. The rests are held in position by a wingnut and screw so that they can be raised or lowered.

GUNS MADE OF ELASTIC STEEL TO SHOOT DEADLY SHELL

"Enormously destructive" shells, secretly developed by armament experts, will be used in the British navy's guns constructed of elastic steel. These shells hold the secret of the sinking of the old battleship "Emperor of India" in naval target practice. The guns are made of a steel alloy called nickel-chrome-molybdenum, which is so elastic that it is possible to make guns with much longer barrels, increasing the speed at which the shell travels. Weight is saved by this alloy, an important point in the construction of fighting vessels under international treaty limitations.

Water Pressure from Long Nozzle Is Digging a Hole to Water Roots of Trees

HYDRAULIC DRILL SAVES TREES BY DIGGING WATER HOLES

Watering of trees during a drouth is made easier through application of the hydraulic-drill principle. A two-foot nozzle, connected by fire hose to the nearest water plug, bores itself into the earth through action of the water, and is left there ten or twelve minutes, depending on dryness of the soil. Four or five such holes, about ten feet from the trunk, will water roots of the tree quickly and more efficiently than by sprinkling the earth around the tree. The flow of the water is regulated by a hand-operated valve on the nozzle.

¶Canada in 1930 ranked second among the countries as a producer of gold, being exceeded only by the Union of South Africa.

MOVIE SHUTTERS ON THE EYES TO AID RACE DRIVERS

Motion-picture shutters are used in a device designed to "slow up" the rapidly flashing impressions passed before a race driver's eyes and brain at high speeds. The device is worn like a cap, with glasses resembling field glasses in front of the eyes, and at the back and above the head, a small motor, which drives the shutter, cutting off the excess number of impressions. The shutter allows the light to come through the opening only twenty-one per cent of the time, thus limiting the number of pictures the eye, and from it the brain, receives, until the brain is able to comprehend all it gets and has a distinct picture of each one. The invention was a result of race drivers' complaints that, when the speed got over 200 miles an hour, the track became a blur and they could not drive faster because they could not see to control the car.

STURDY SIDECAR FOR BICYCLE IS EASILY ATTACHED

Space for an extra passenger, or for luggage, is provided with a sidecar for bicycles which is both light and sturdy. It is equipped with adjustable clamps and fits any standard bicycle. The body can be obtained in the form of a seat for one passenger or a box for carrying packages in making deliveries.

Bicycle with Light but Sturdy Sidecar for Carrying Extra Passenger or Luggage

Electrically Operated Turntable for Amphibian Airplanes at a Beach Airport on Catalina Island; the Beach Is Too Small for the Planes to Be Turned without Its Use

TURNTABLE AT SMALL AIRPORT FOR AMPHIBIAN PLANES

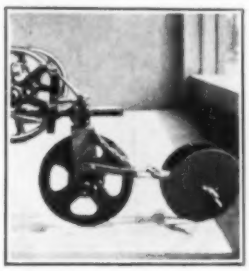
To solve the problem presented by a landing field too small for an amphibian airplane to turn around, a turntable, similar in principle to those used for locomotives, has been installed at the beach airport on Catalina island, off the coast of southern California. The airport is located in a narrow canyon that opens out to sea. Amphibians from the mainland alight on the water, taxi inshore to a forty-foot concrete ramp that extends 120 feet out to sea, then wheels are lowered and the ship runs up the incline and onto the turntable, which is twenty-five feet in diameter and electrically operated. This enables the ship to be moved about within a space represented by its own wingspread, where otherwise a field of several hundred square yards would be required.

"ELECTRIC EYE" TO ROUTE MAIL AT RAILWAY TERMINAL

Sacks of mail will be correctly routed at railway terminals by equipment using the photo-electric relay, or "electric eye." Each sack is loaded with mail for one city, then placed in a tray container which travels on an automatic conveyor of the overhead monorail type. The containers are made up into "trains" pulled along at about five miles an hour by a motor-driven carrier, as many as fifty containers making up the train. The train has for its destination a number of railway mail cars, each going to a different city. As the train goes by, the mail sacks are automatically sorted and dropped on the loading platform near the proper car. From each mail car is projected a beam of light at an angle different from that of all other cars. The photo-electric relay on each mail-sack container is set at the angle corresponding to that projected from the railway car to which the mail is going, and when the container reaches that point, the mail sacks are dropped. The relay tubes are set at the dispatching platform after the mail sacks are loaded and the destination tags inspected.

ELECTRIC GUIDE FOR TRACTORS TAKES OPERATOR'S JOB

Operators of farm tractors are about to lose their jobs to an electric guide. The farmer makes the first furrow, and the guide wheel does the rest. One man can keep several tractors in operation at the same time, because he has nothing more to do than servicing the machine.



The Glories of Kings

House in Marie-Antoinette's Playground Being Repaired; Below, Cleaning Statues by Steam Process

VERSAILLES and Fontainebleau, magnificent palaces of so many of France's famous rulers, have been saved from ruin, restored to their original beauty, and made secure against the elements and decay for centuries to come, at a cost of millions of francs.

This work is chiefly due to the generosity of John D. Rockefeller, Jr., whose donation to augment the French state funds has made possible a rapid renewal of the splendor of a bygone age.

Through the work, the palace of Versailles, the two Trianons, the hamlet of Marie-Antoinette, her milkhouse and her theater, and most of the grounds are made once more practically as they were in the romantic days after their completion. Fontainebleau, even older, and linked with such great figures as Louis XIII and Napoleon Bonaparte, the only great castle of the period completely furnished today, also has been saved through the American donation.

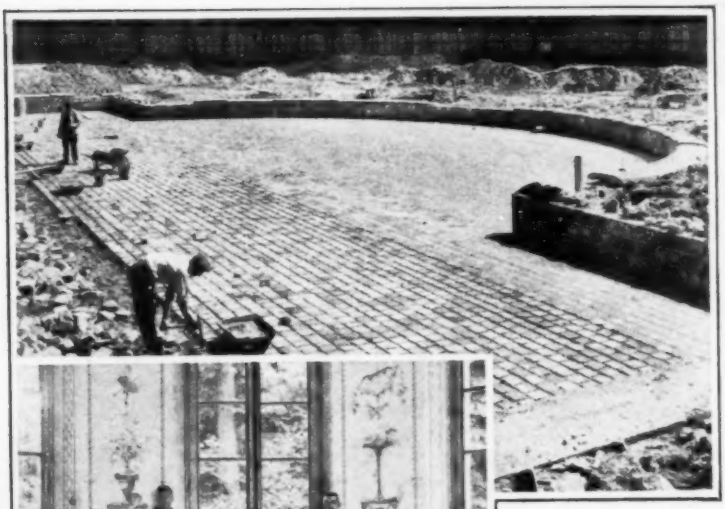
In the days when the palaces of Fon-

Restored *with* American GOLD

tainebleau and Versailles were erected, men had not mastered the art of building waterproof flat roofs. The entire roof of Versailles was a ruin, and the interior was being destroyed by rain.

In all, thirteen roofs of the palace at Versailles have been entirely replaced. The original roofs had been built in the time of Louis XIV, in 1661, of lead and slate, laid over a wooden structure which had rotted in some places and been badly worm-eaten in others. The first step in the repairs was to erect a structure over all the surface to be covered. This was called an "umbrella," made of heavy timbers and covered with corrugated iron. This protection was high enough so the workmen could operate underneath. Lead and copper replaced the slate on all flat surfaces. The lead was laid in large sheets

Basin of Neptune at Versailles, Above; and Bust of Hannibal, Below, after Cleaning



with overlapping seams welded together to form a perfect whole. On the steep slopes slates were again laid to retain the general aspect.

Over the chapel the usual umbrella was constructed. The old roof was removed and the rotted oaken beams were put in iron casings. These casings were extended in such a way that the timbers no longer rested upon the ceiling, but were lengthened sufficiently to rest on the columns supporting the walls. A light double ceiling of hollow bricks was then constructed over the original one, after which the roof was rebuilt. It is absolutely waterproof, and in this way it is estimated the delicate paintings of the ceiling are protected for centuries to come.

Another important work was the repairing of all the doors and windows. At some previous time, the costly little panes had been changed to large ones, out of keeping and harmony with the architecture. When replacing the windows, the small panes, as originally used, have been restored.

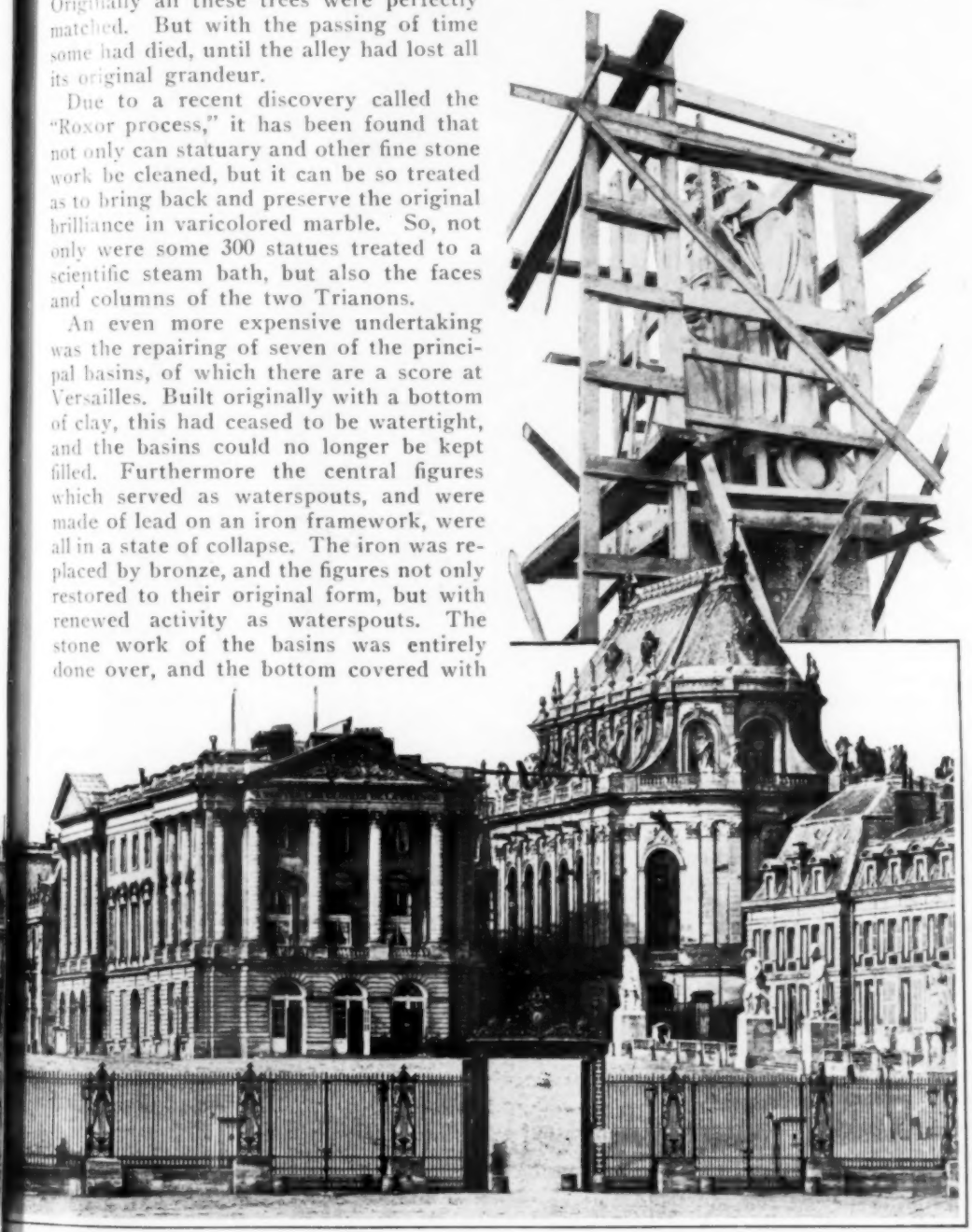
Reclaiming the Basin of the Plat Fond, at Top, a Most Important Feature of the Restoration; Center, New Floor in the Music Room, and Below, the Versailles Court of Honor

One of the finest things achieved at Versailles is the replacing of the alley of trees which for a distance of nearly a mile reached away on either side of the roadway leading from the Great Trianon. Originally all these trees were perfectly matched. But with the passing of time some had died, until the alley had lost all its original grandeur.

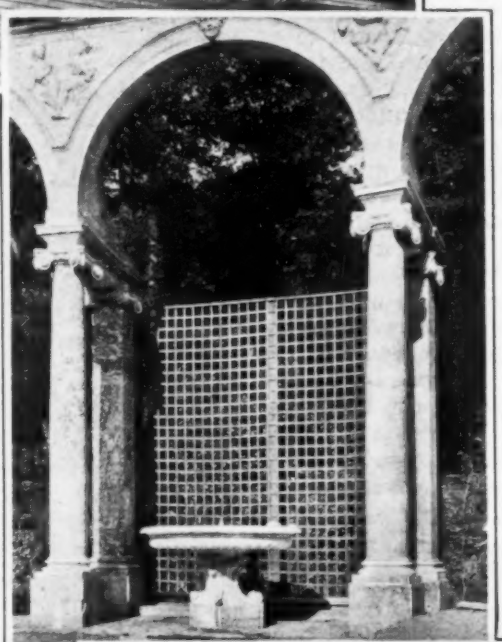
Due to a recent discovery called the "Roxor process," it has been found that not only can statuary and other fine stone work be cleaned, but it can be so treated as to bring back and preserve the original brilliance in varicolored marble. So, not only were some 300 statues treated to a scientific steam bath, but also the faces and columns of the two Trianons.

An even more expensive undertaking was the repairing of seven of the principal basins, of which there are a score at Versailles. Built originally with a bottom of clay, this had ceased to be watertight, and the basins could no longer be kept filled. Furthermore the central figures which served as waterspouts, and were made of lead on an iron framework, were all in a state of collapse. The iron was replaced by bronze, and the figures not only restored to their original form, but with renewed activity as waterspouts. The stone work of the basins was entirely done over, and the bottom covered with reinforced concrete to make it watertight.

The two Trianons, built in the times of Louis XIV and XV, had been left unrepaired for many years. The roofs were replaced, and the court was repaved ac-



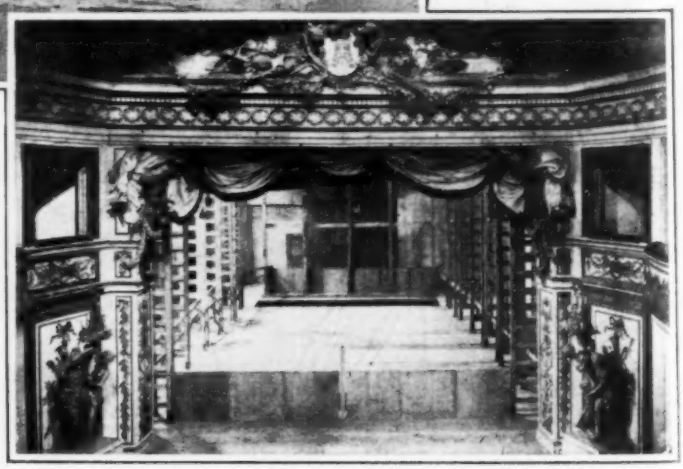
Statue of Sully, Above, One of Fifteen in the Court of Honor Shown Below; All Were Placed in Gigantic Crates and Removed to Restore Ancient Artistry



cording to the plans of Mansard, which were found in the archives of the palace. The grillwork was also repaired and the level of the garden, which had been destroyed, was restored. In the park, the queen's music room was also the object of a thorough overhauling, bringing out an interesting discovery and a method to overcome the failure of the first builders. This charming circular building, supported by fluted columns with French windows between, was in a state of dilapidation. The floor, which had been originally an excellent mosaic of marble, was eaten by dampness and many of the marble pieces were broken or missing. The whole floor was taken up and the principal source of the mischief discovered in the lack of foundation for the building.

A very ingenious system of aeration was constructed. The basis of this was putting on the ground a thick layer of coke. Then some low concrete sills were built, partitioned in squares. A floor of concrete was then laid, over which the marble mosaic was reconstructed.

Of all the work, perhaps that which will most appeal to the visitor of the future is the reconstruction of the tiny theater of Marie-Antoinette. Here is the most perfect little auditorium with a balcony in all the world; not only this, but a theater equipped with a stage of a depth and mechanism surprisingly large and ingenious, and still working perfectly today. To anyone familiar with the operating of everything behind the scenes, this theater of the tragic queen



Flyloft of Theater, Restored Lattice and Theater Interior

is a veritable revelation. Few know anything about the theater as it has never been regularly open to visitors.

It was built at the whim of Marie-Antoinette. Here she tried to relieve her boredom by producing little plays with the assistance of some of her court. In the auditorium the king sat with a very few invited guests. When the work started, a piece of the original curtain still hung in place, and the decorations of papier-mache were almost entirely intact and still retained their deep blue and gold coloring. The stage is slightly larger than the auditorium with a height of seventy feet. The beams in the flyloft, the blocks and pulleys are the original ones and in perfect working condition. The upper part of the flyloft had a series of twenty-one wooden drums, which operated the numerous drops. A new floor in the auditorium, a new floor for the stage, a little fixing of the mechanism, and the theater will now operate as in the time of the queen.

The hamlet, the playground of Marie-Antoinette, also has been made to live again. Each of the little houses which formed the village has been repaired. The queen's milkhouse, which had best escaped the ravages of time, and is practically as it was when she played at being a dairy maid, is to be operated again. The interior of this charming little place is lined with white marble. In the center of the room is a large rectangular table of marble upon which butter could be worked. The floor also is of marble.

For a great many years architects have known that the chief factor in the destruction of stone work and buildings was the ravages of dampness. For half a lifetime a Belgian inventor, by the name of Knapen, had been seeking a solution, which he finally succeeded in having taken up about the time the work at Versailles commenced. This solution was a system of aeration of the stone, which consists of cutting a small aperture into the stone, triangular in shape. A pipe, about fifteen inches in length and one and one-half inches in diameter, is inserted at a downward angle. Over the opening is placed a triangular grillwork, through which the air penetrates while the dampness drains out.

Soap Sculpture Is Simplified with These Bars, in Which the Figures Appear Partly Carved

SOAP SCULPTURE MADE EASIER WITH HALF-CARVED BARS

Soap sculpture for school children, and others interested in this pastime, is greatly simplified with soap bars in which the figures of animals and other objects appear partly carved in the bars themselves. Beginners are furnished with bars in which most of the carving is done, and they simply cut away the excess soap to leave exposed the completed figure. As they become more skillful, bars are supplied with less of the figures completed, thus requiring more carving. All the tools needed are a knife and a fine-tooth comb for making hair lines. The figures last indefinitely, and the soap chips may be heated and made into bases for the figures or tied into pieces of muslin to make washcloth and soap combinations.

¶The Popular Mechanics Bureau of Information offers its free service to all readers of this magazine. Names and addresses of manufacturers and dealers in articles described, and any other details in our possession, will be promptly furnished.

SKYSCRAPER IS LIGHTNING ROD FOR NEW YORK BUILDINGS

Hundreds of New York buildings are protected from lightning today by the Empire State building, world's tallest skyscraper, which acts as a huge lightning rod to guard near-by structures. In addition, the Empire State building has nothing to fear from the bolts, because it is well grounded by its extensive steel work. Proof that this huge structure guards near skyscrapers from lightning was obtained in recent experiments in the laboratories of the General Electric company where a model of the skyscraper and of other buildings was constructed. Bolts of man-made lightning of 5,000,000 volts were shot repeatedly at the miniature skyline, and each time the pinnacle of the Empire State model was struck, but no damage was done, as it was grounded just like the real structure. The area of protection is cone-shaped, such as would be included by a line drawn from the top of the building to a radius of about two and one-half times the building height for clouds a mile high. The protected area would be reduced should the storm cloud be exceptionally low. For low buildings the protected radius may be four times the height of the structures and thus, while taller buildings protect a greater area, their efficiency is relatively less because they are closer to the clouds.

Model of Empire State Building as It Was Struck by Bolt of Man-Made Lightning to Prove That It Protects Near-By Buildings, Also Represented by Models, without Being Injured Itself

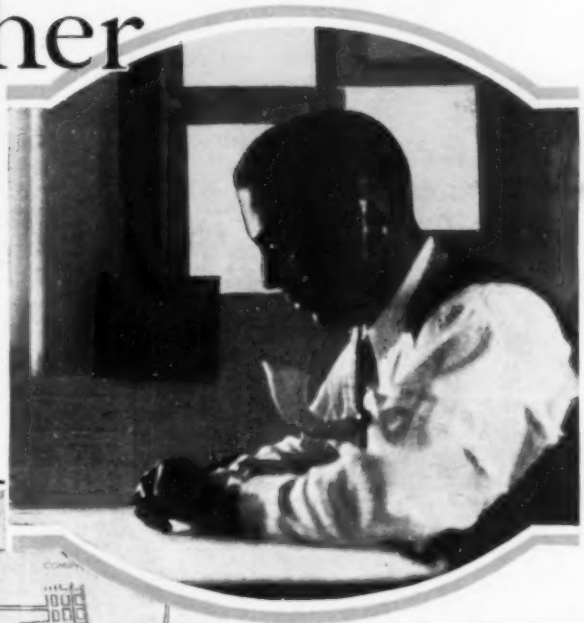
PLANES GAUGE SPEED OF BIRDS BY FLYING WITH THEM

Airplanes have been used successfully to measure the speed of flying birds by the simple expedient of chasing them, and watching the reading of the air-speed indicator when birds and ship are flying at about the same rate. By this method, the flight of a flock of geese was shown to be at the rate of from fifty-two to fifty-six miles an hour, while wild ducks made forty-six miles an hour. Teal are extremely fast, their speed being recorded at about seventy miles an hour. Some birds cannot be timed accurately since they make so many turns to escape.

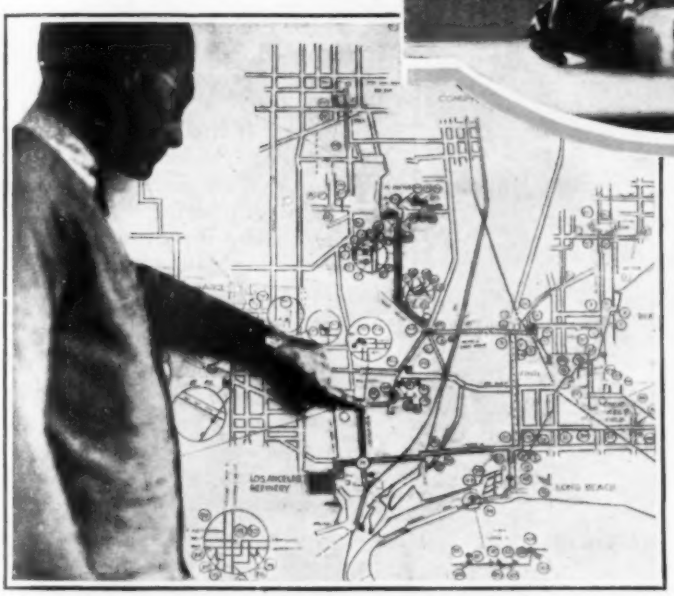
With the Pipe Line Dispatcher

WEAVING back and forth across the United States and touching nearly every center of population, nearly 100,000 miles of pipe lines carrying petroleum and its products are in use at present.

Oil flowing out of the ground in Texas is delivered underground to New York. Oil from Oklahoma may be pumped direct to Ontario, or may be diverted from the main trunk line to supply a refinery near Chicago. In areas where fields, refineries, storage tanks, and delivering facilities are in close juxtaposition, each oil company has a complex short-haul pipe system. Oil is pumped from the fields to refineries or storage tanks, from tanks to refineries and return, and from tanks and refineries to ship-loading and truck-loading terminals.



Dispatcher Whose Office Never Closes; Often a Thousand Phone Calls Are Handled in Twenty-Four Hours



Dispatcher's Board, Ten Feet Square, Which Reflects Operations by One Company on All Its Lines in a Single City Area

Like the railroad companies, the oil companies have built lines, feeder lines, storage tanks and switching yards. Movement of the oil is handled like railroad traffic, through central dispatching offices.

At each central office, a dispatcher is on duty every hour of the day and night. An intricate telephone network connects him with every outlet valve and pump house. He plans the routing of each shipment of oil and is responsible for all its movements. Dispatchers' orders go out to cover the opening or shutting of the valves and the operation of the pumps. Mistakes in this work may mean contamination of the oil, loss of time and possibly broken pipes.

Always get one valve open before you close one, is an old pipe-line rule that is

Pipe Line Switchyard, Above; in Fires the Dispatcher Must Route the Oil Away from the Hot Area

impressed upon new workers. All orders are repeated back to the dispatcher, and he is notified when the orders have been executed. The hour and minute at which each order is performed is recorded.

As a final precaution, the gauges at each terminal are checked every hour. If the gauge at the receiving end shows more barrels per hour than does the intake gauge, oil is pouring into the line through some forgotten valve. If the receiving gauge shows fewer barrels than are being pumped, then oil is being lost through an open valve or leak.

In long cross-country lines, efforts are made to confine shipments to the same grade of oil, due to the large amounts that remain in the pipe after a shipment is completed. In one 800-mile gasoline line, more than 10,000,000 gallons of gasoline are held within the pipe.

In the shorter, more intricate underground systems, batches of different grades of oil are pumped in succession. The small amount of contaminated oil between each batch is usually pumped out with the shipment of the lowest grade, or is diverted into storage tanks for return to a refinery.

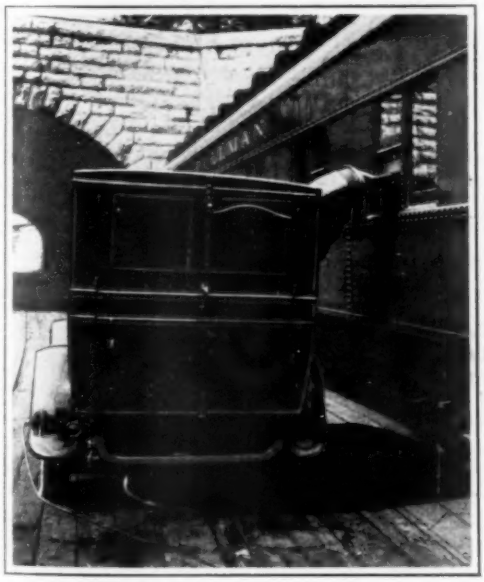
Most high-grade crudes flow freely through the lines at ordinary temperatures, but some of the heavier grades

must be preheated so that they will move easily.

When heavy fuel oil is to be moved, the dispatcher prepares for it at least thirty-six hours ahead by ordering that the oil then passing through the line be heated. The entire length of the pipe is heated before the heavy oil is pumped in. The increase above normal temperature must be built up slowly to reduce the possibility of line damage from overrapid expansion. When the entire line has been heated, the fuel oil is pumped through. The batch which follows is started at a high temperature and its heat is gradually reduced, allowing the line to cool off slowly.

AUTO PUMPS ICE-COOLED AIR INTO SLEEPING CAR

Iced air, pumped into sleeping cars, keeps night travelers comfortable. A small auto truck, equipped with a large pipe which has a connection fitting the train car windows, is used by the Baltimore and Ohio railway for this purpose. A large fan draws the outside air across ice cakes and discharges it into the car through a window in the passageway, thus lowering the temperature by several degrees. Warm air passes out through overhead ventilators.



Auto Truck Is Shown with Connection to Railway Coach for Cooling the Air for Night Passengers

CARDS ARE COPIED BY CAMERA MAKING TWO PER SECOND

Dexigraph Which Copies Two Index or Catalog Cards per Second Is Shown in Operation

Cards used in library catalogs, or similar ways, may be copied at a rate of 7,200 per hour by a machine called the "dexigraph." It can make as many as six copies of the same card at a time. The device was developed while Yale University was having its library-catalog cards copied by hand, a task at which a large number of clerks had worked for twenty years and had completed only 100,000 of the 1,250,000 in the catalog. The dexigraph is a specialized camera using rolls of highly sensitive paper, which is of sufficient weight to be used as cards after it is developed and cut. A picture is made of each card, with negatives produced on the first run. Some companies use them in this form, with white printing and writing on a black card. If the positive card is desired, it is necessary to run the negatives through the machine again. Libraries, insurance companies, banks, credit associations and other organizations requiring wholesale copying of card catalogs are speeding up their work with the dexigraph. The Yale library catalog was completed in a few weeks by one operator using the new machine.

¶World registration of motor vehicles on Jan. 1, 1931, totaled 35,805,632, of which 26,697,308 were registered in the United States.

MUSIC INSTRUMENT ON A STICK SOUNDS LIKE A VIOLIN

Single-Stringed Musical Instrument That Is Fingered Like a Piano and Played Like Violin

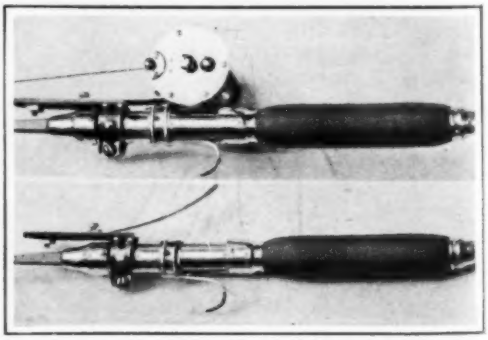
Tones an octave higher or lower than the violin are produced on a single-stringed musical instrument that somewhat resembles the one-stringed Japanese instruments. It is called a "vio" and consists of a five-foot mahogany stick to which is attached a small oblong sounding box open at the back. The metal string stretches from the top of the pole to the bottom, being supported on the box by a bridge. Fingering is much the same as for the piano, white and black keys being indicated on a tape beneath the string. A bow is used to play the vio, the sound being produced by drawing it across the side of the string and the upper edge of the box simultaneously. The tone resembles that of the violin but is not so penetrating.

MECHANICAL AUTO-SPEED CURB SOUGHT FOR WILD DRIVER

Mechanical limitation of auto speeds by state laws ordering installation of governors on all motor vehicles is forecast by Robbins B. Stoeckel, Connecticut commissioner of motor vehicles. This will be the result, he says, of automotive operators' failure to govern their own speeds to conform to driving conditions. The recording speedometer is another suggestion of the commission, who pointed out that this device will keep a record of an auto's speed for varying periods or distances. Should such a device be required by states, with an accompanying sealing apparatus to keep owners from tampering with it, there would be a perfect record for investigation of speed and for a suppression of high speeds where such were indulged in to unreasonable limits. The one difficulty about the recording speedometer is that it is impossible to determine the traffic conditions under which the auto is driven at high speed. Several states already have considered installation of governors on commercial motor vehicles, but such legislation has been discarded on account of imperfections in the governing devices.

AUTOMATIC "THUMB" FOR REEL PREVENTS BACKLASHING

A simple means of preventing backlash of the line on a fishing reel is found in a spring which clamps on the rod and, passing under the reel, directly engages the line and holds it snugly, acting as an automatic "thumb." The tension of the spring may be changed, and the whole assembly can be attached to different-sized rods and reels, as it is supplied in an adjustable form. In addition to preventing backlash, the thumb also serves to hold the reel more firmly on the rod. No injury is done to the line through operation of the apparatus.



Automatic "Thumb" for Fishing Reel Which Prevents Backlashing of the Line

Brain Teasers *that will test your skill*

Working the "Tower of Hanoi," One of the Oldest and Most Intricate Puzzles Known, Originating in the Far East

BRAIN teasers, those puzzles that look so impossible, but most of which are so simple if you find the hidden "catch," have risen to a position of importance in courses at a southern university.

Prof. R. D. Doner, of Alabama Polytechnic Institute, is using a great many of the old and new brain teasers as a diversion and as the first step toward interesting his students in higher mathematics.

One of his favorites is the ancient puzzle known as the "Tower of Hanoi," said to have started with Brahma. In its original form it consisted of three towers, on one of which was placed sixty-four disks of gold, with diameters varying large to small from bottom to top. The task Brahma is said to have set his followers was to move the disks to one of the other towers, without ever placing one upon another of lesser diameter. It could be done, but it would require 18,446,744,073,709,551,615 separate moves.

Doctor Doner's version of this teaser, however, consists of only seven disks and three spikes, and requires considerably less time to complete than the original.

Another puzzle which will test your prowess consists of a number of small rings fastened to a metal bar and a wire handle in such a way that the rings at one end of the puzzle can be removed from or replaced on the handle. Only a single ring can be removed or replaced at a time and the normal order of the rings cannot be changed. A ring can be removed only when the one next to it in the direction of the closed wire end of the handle is in proper position and the other rings at that part of the handle are removed. To solve the trick and get the

Can You Solve This One?

ON a train the names of the fireman, the brakeman and the engineer are Smith, Jones and Davis, but not respectively. On the same train there are three passengers with the identical names, Mr. Smith, Mr. Jones and Mr. Davis.

1. Mr. Davis lives in Detroit.

2. The brakeman lives half way between Detroit and Chicago.

3. Mr. Jones earns exactly $2,000 a year.

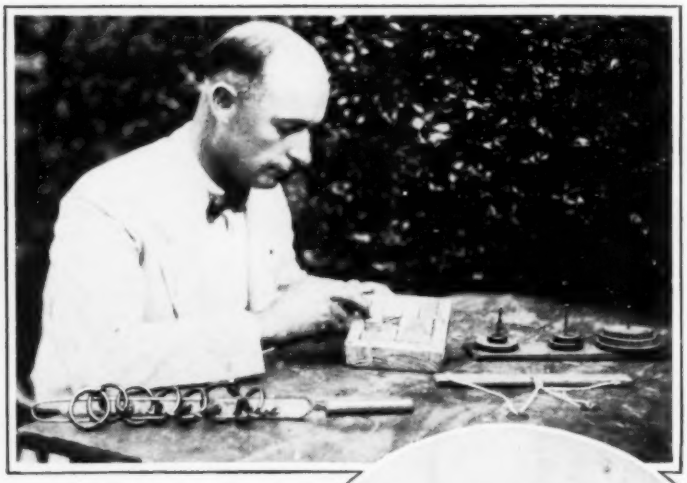
4. Smith beats the fireman at billiards.

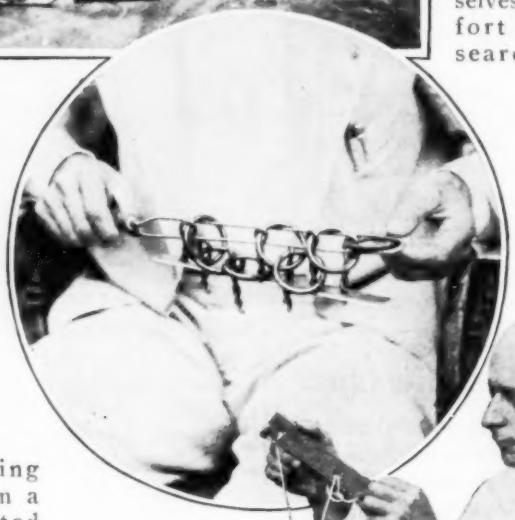
5. The brakeman's nearest neighbor, one of the passengers, earns exactly three times as much as the brakeman does.

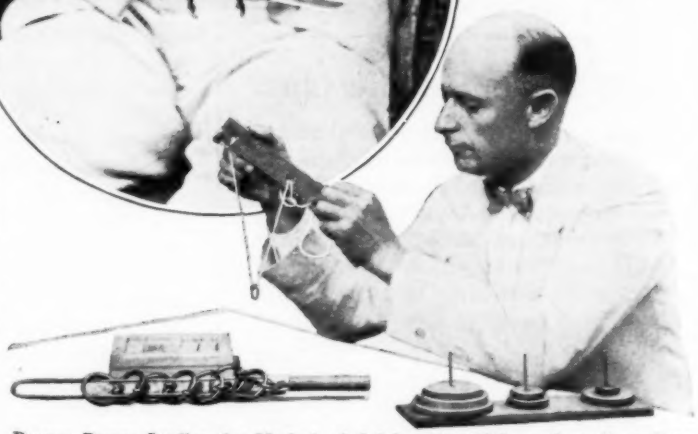
6. The passenger with the same name as the brakeman lives in Chicago.

What is the name of the engineer?

The answer will be found on Page 575







Doctor Doner Studies the Method of Solving the "Fifteen Game," at Top; the Chinese Rings, Center, and the "String and Rings" Puzzle

rings off the handle or to remove the handle from the rings is really the sum or product of a geometric series which involves 127 moves or "steps."

What is called the "fifteen" trick is another mathematical puzzle which tests your skill in maneuvering numbered blocks in a shallow box of limited dimensions in such manner that a blank may negotiate the circuit of the receptacle occupying all positions in the container in regular sequence. To start with, the box, which is large enough for sixteen cubical blocks, contains only fifteen. These blocks are shifted about in such manner that the blank in succession appears at every possible position in the box.

Another problem is that of the numbered squares which was originated in India before Christianity. The test in this game is to arrange the magic squares in such alinement that the sum of the numbers in every row, column and diagonal will be alike. History records that this trick, which features fun with figures, was used during the ancient age of superstition as a charm against the plague.

The famous Josephus problem is a puzzle of human decimation by the law of chance. The ancient accounts claim that Josephus once saved himself from death by his knowledge of such arithmetic riddles. Josephus and thirty-nine others concealed themselves in a cave in an effort to evade Roman searchers who sought their lives. All except Josephus and one other man were so disheartened that they resolved to kill themselves. Josephus suggested that the men form a circle and numbering from a given point every third person named should be killed. This was done but Josephus and his one supporter who selected the thirty-first and the sixteenth positions in the circle escaped.

The records show that such necromancers of numbers as Alcuin, di Burgo, Tartaglia and Cardun were prominent among the oriental pathfinders who were the first to appreciate the importance of arithmetical recreations both from the

general amusement and educational standpoints. According to an English authority, these forebears of the pastimes which specialize in fun with figures were the sources of a great variety of trick or catch problems. One of these freak questions follows:

Three highwaymen stole a vase containing twenty-four ounces of balsam from its owner. During their escape, they stole three glass jars from another householder. On arriving at a place of safety, they sought to divide the balsam equally. They then discovered that their stolen containers were unequal in size. One held five, another eleven and the third thirteen ounces of balsam. How could the robbers divide their booty into equal parts?

Old records laud Zeno as one of those who delighted in unraveling such number mysteries. Zeno was he who claimed that fleet Achilles would never overtake a tortoise, given 1,000 yards' start, although his ordinary running speed was ten times as fast as the gait of the tortoise.

Note: **The brakeman's name is Jones; the fireman's, Davis, and the engineer's, Smith.**

FIREWORKS TRICK U. S. VOLCANO INTO SYNTHETIC ERUPTION

Tons of fireworks planted in the crater of Mount Lassen, California, were exploded at the opening of Mount Lassen Volcanic National Park, sending that old volcano into an awe-inspiring eruption such as had not been seen since its outburst in 1914. The fireworks were arranged with fuses connected to a control board. At this keyboard a man stood, controlling, for the first time in history, the synthetic eruption of a real volcano.

Photo by General Photographic Agency

Interior of Plane Used by London Traffic Police; Crowded Derby Day Roads May Be Seen to the Pilot's Left

FLYING POLICE ORDER TRAFFIC BY RADIO TO GROUND

Airplanes recently were employed by London police to help them regulate the huge volume of traffic, both motor and pedestrian, on the roads leading out of London and Home county towns to Epsom Downs, the scene of the great English Derby. When a pilot spotted a traffic block, he radioed the news to the patrol below, and orders were telephoned to foot and mounted police to divert the flow from that particular point.

¶We want all our readers to write us freely and often whenever they wish additional information on articles published in this magazine. Address Bureau of Information, Popular Mechanics, Chicago.

Bandit Car Shot with Dye Gun Easily Traced

Shooting at a Bandit Car with the Dye Gun, Above, and the Distinctive Mark Left by the Shell When It Hits, Below

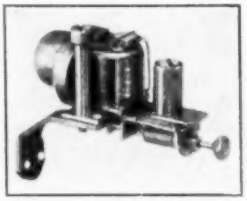
A pistol that shoots a small celluloid shell full of a red dye has been recently devised for the use of police in chasing bandit cars or hit-and-run drivers. When the shell strikes the back or side of the fleeing car, it splashes red paint, making the car easy to trace. The projecting mechanism is a powerful spring, which will shoot the shell more than 900 feet. It is designed particularly for use in downtown areas of cities or other crowded districts where it is highly dangerous to fire on fleeing cars.

PISTOL BETTER THAN THE BOW IN ACCURACY TRIALS

That the pistol is more accurate than the bow, a question long a favorite argument, recently was determined in Los Angeles when members of the crack police pistol team defeated a picked quartet from the Ambassador archery club. The marks were standard American fifty-yard pistol targets. Firing thirty rounds of ammunition and thirty arrows, and allowing the archers a handicap of seventy-five points out of a possible 300, the police team scored sixty-three more points than their opponents.

RIBBON INKER ON TYPEWRITER INSURES CLEAR COPY

Life is added to typewriter ribbons by the use of an automatic inker that insures clear copy after the ordinary ribbon has lost its usefulness. The inker can be attached to any typewriter and is started by moving a lever when the ribbon begins to show wear. Inking takes place while typing is being done, and the attachment is available for the black half of red ribbons, or there is a model designed to ink both sides.

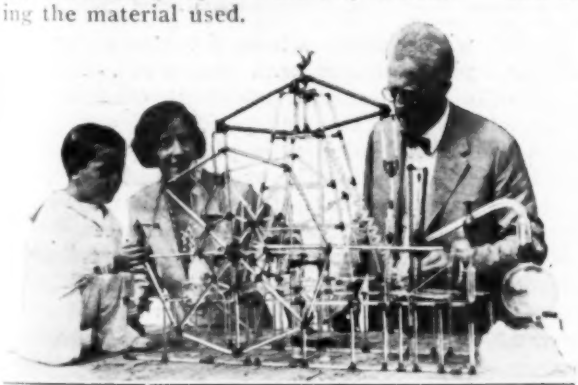


BATTERY A FOURTH-MILE LONG TO RUN PHONE EXCHANGE

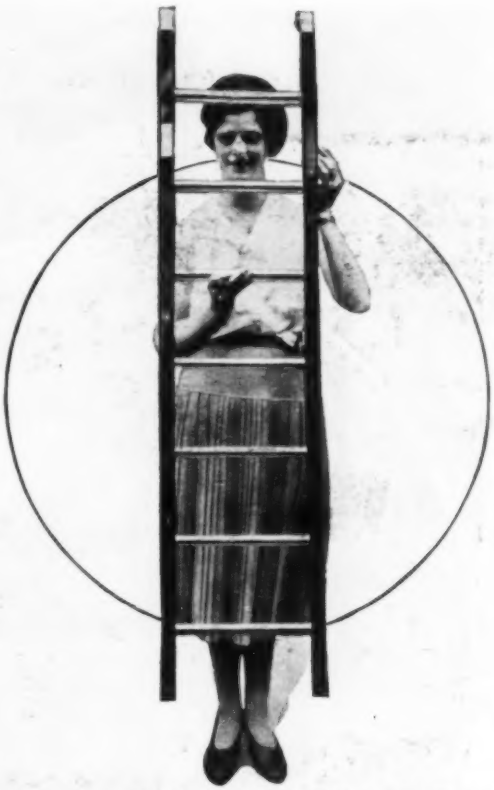
Because dynamos are too noisy, big telephone exchanges are forced to supply the electricity that carries the message over the wires from storage batteries. The bigger the exchange and the more traffic it handles, the bigger must be the battery. Next year the Farm street, Mayfair, exchange in London will have 30,000 automatically operated lines, and a battery of gigantic proportions now is being constructed for it. One hundred and fifty men are employed at the factory on this one battery, which, it is estimated, will take six months to build. Each cell will be nine feet long and the whole battery of 300 will be approximately a quarter of a mile in length. It will weigh more than 400 tons, and 4,000 gallons of dilute sulphuric acid will be needed for the electrolyte. Its capacity will be 13,000 ampere hours, enough to supply the current for a five-tube radio set from now until 1957, without recharging.

STEAM ENGINE MADE OF GLASS RUNS AS CHILD'S TOY

Pieces of glass tubing—374 pieces of them—were used in constructing a model steam engine by a California glass blower as a birthday present for his grandson. The engine, generating one-twentieth horsepower, is three feet long, twenty-two inches high, and its power comes from steam produced by a small alcohol lamp. It took the designer eleven months to complete the model, which engineering enthusiasts say is a marvel, considering the material used.



All-Glass Steam Engine, Made for Boy, at Left, by His Grandfather, at Right, Actually Runs



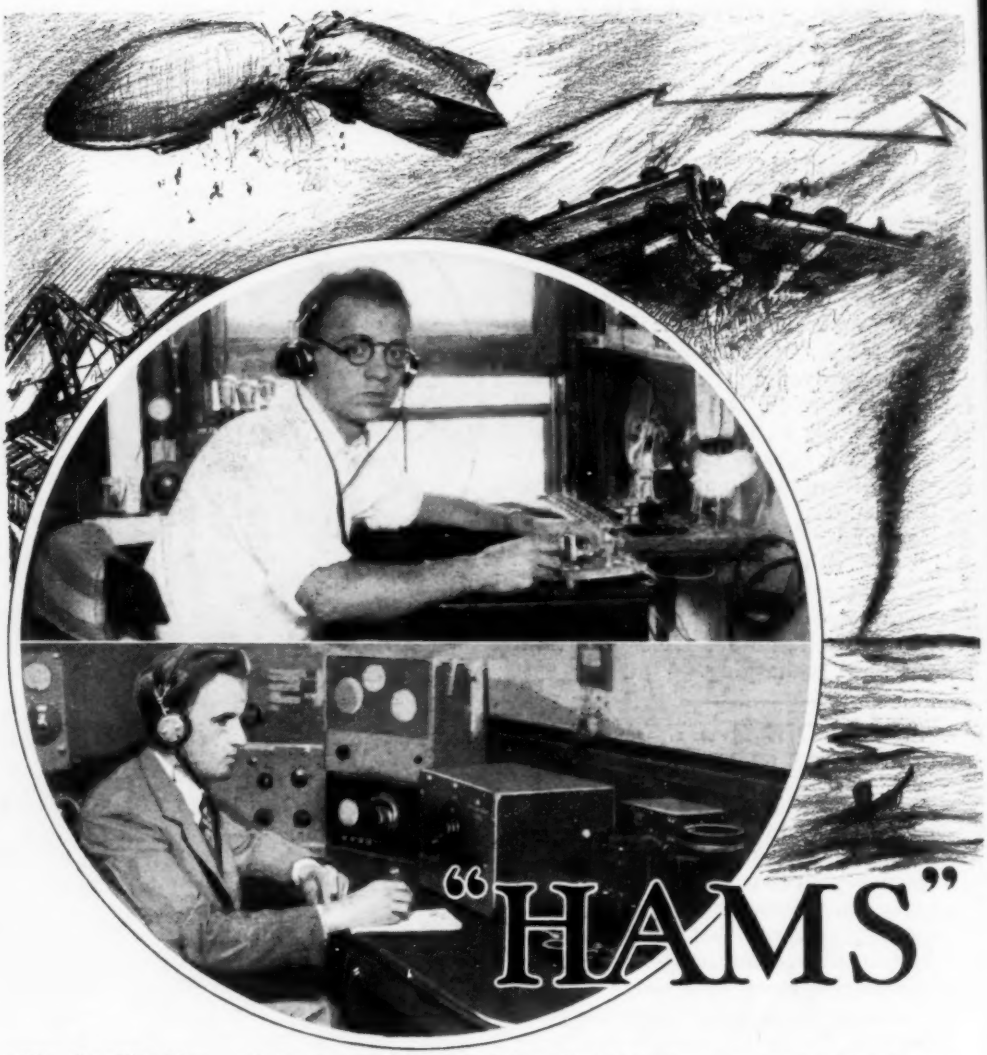
Four-Ounce Aluminum Ladder, Held by the Young Lady, Can Support a Weight of 500 Pounds

LADDER WEIGHS FOUR OUNCES HOLDS UP QUARTER TON

Four ounces of aluminum, made in the form of a ladder, supported a quarter-ton weight at an English exhibition. The ladder is the lightest weight for its capacity of any ever exhibited in Great Britain, and attracted wide attention.

FUNGUS THAT CAUSES TREE ROT FOUND

Eight years of search for the fungus which causes brown heart rot in California redwood trees has been successful. The fungus was found by a research worker at the University of California, and laboratory tests have definitely proved that it was the organism sought. It also was determined that the organism gains a foothold on the trees through trunk scars caused by fire.

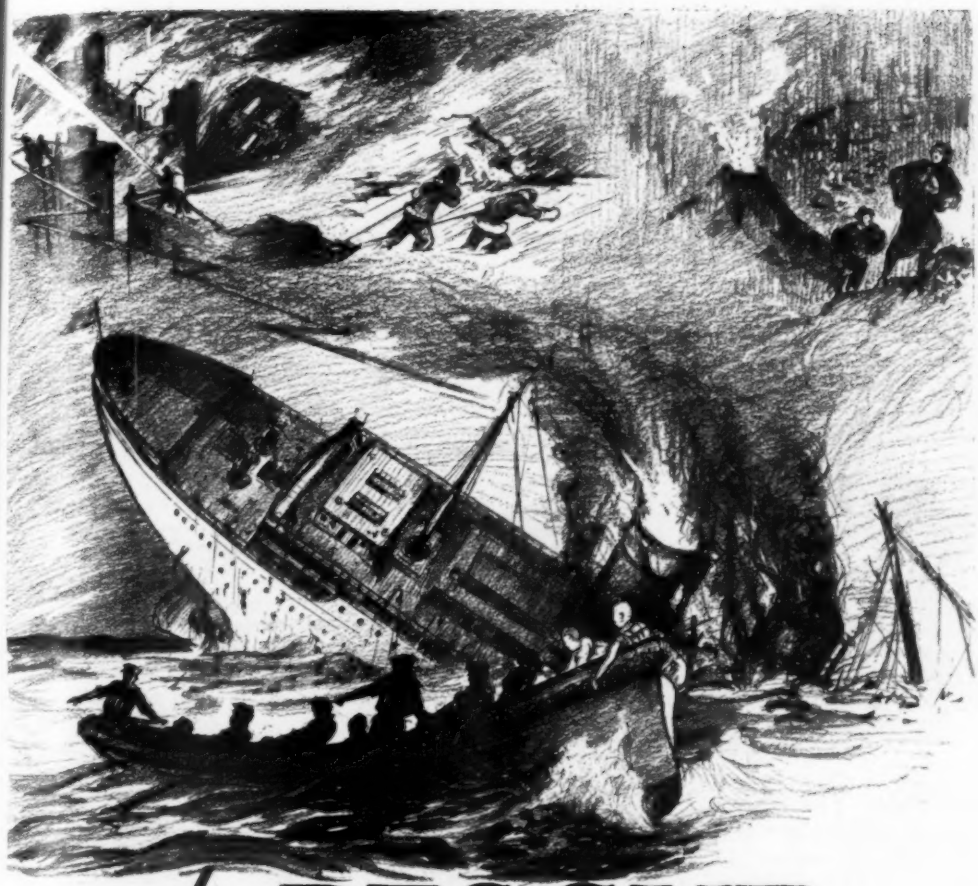


"Ham" 2APD, Above, and the Owner of VE1AL, Below; Both Operators Have Served Long Hours at Their Sets in Crises, Such as Those Shown, When Other Communications Failed

A SNOW and sleet storm strikes North Dakota and Nebraska, interrupting all communication channels, clogging highways and railroads. Telegraph and telephone wires come down with the weight of the frozen sleet and ice, covering them like thick ropes. Poles snap under the weight of the white-coated wires. Trains are blocked and there is no way of reaching the outside world. Even power has failed in some places.

At each point, radio amateurs learn of the communication break, and drop all other work to try to bring the isolated towns and railway points into contact with regions where the storm has not played havoc with the wires. Railway dispatchers and telephone officials have called on these chaps for aid.

With batteries in place of power lines, with all thought of sleep put aside, the radio amateurs of North Dakota and Nebraska set to work. Within a few hours they have communication going full blast via their stations. Railway officials outside the states affected learn the extent of the trouble and urgent telegrams are cleared by radio. Repaired power lines first are run to the amateur stations so that better communication can be estab-



to the RESCUE

lished. Telegraph linemen are soon repairing wires, but five days elapse before the whole structure is functioning again. During that time low-powered amateur transmitting and receiving equipment, for the most part homemade, has successfully bridged the gap.

In New Zealand an earthquake wrecks two resort towns, cutting off all communication. The first call for help comes when, in a radio test room in Wellington, a faint message from the stricken areas is picked up, requesting doctors, nurses and food. The message comes from an amateur station, set up among the ruins of the operator's home. His regular equipment smashed with the caving in of the roof of his house, the operator has rescued what parts he could, scoured the ruins of several battery shops and picked up a number of batteries which he took home. Here he has set to work, built a small transmitter and receiver, powered with the rescued batteries, and sent his request for help. His is the only link between the earthquake-shattered towns and the outside world.

These are two recent cases where amateur radio operators have come to the rescue. In the United States, there have been more than twenty disasters within the last ten years in which radio as a hobby has come to the aid of large marooned communities. A vast system of emergency stations has been built up by radio amateurs, so they can come to the aid of

Operator of W9DHO, Above, Who Has Come to the Rescue Many Times When Snow Brought Chaos in Nebraska; Typical Traffic-Handling Station

communication when the usual channels no longer function.

There are 20,000 radio amateurs in the United States alone and another thousand in Canada. Throughout the world there are several thousand more. All operate radio transmitters for experimental purposes on short-wave bands. With these transmitters they can reach to all parts of the world either by using the Morse code or by telephony. Telegraphy is the more common form of operation, requiring less power to cover longer distances than telephony. Scheduled contacts are often kept between a number of stations to study conditions and improve operating technique. From such contacts have come the national emergency networks in the United States, co-operating with the army, navy, Red Cross, railroads and communication companies.

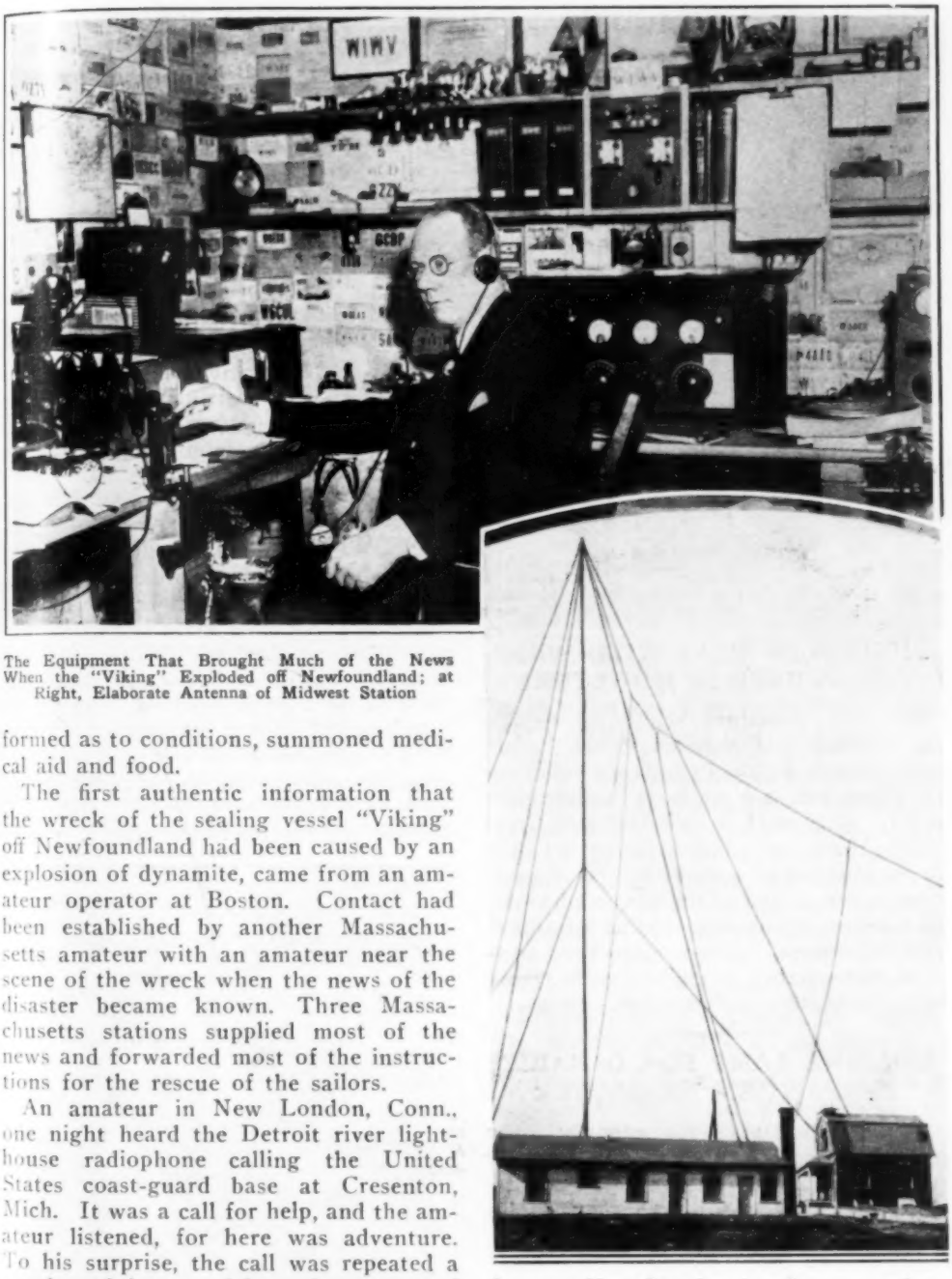
The army network of amateur radio stations recently handled a Red Cross message to show the speed with which these volunteer radio experimenters can come to the aid in emergency. A seventy-six-word message was dispatched from Washington, picked up by 494 amateur stations in as many cities and towns and rural communities, and within twenty-four hours, 481 of these messages had been countersigned and delivered to the local Red Cross officials to whom they were addressed.

To belong to any of the networks for emergency communication work requires high standards. These all co-operate with the American Radio Relay league, the national transmitting amateurs' organization.

These various networks which can be quickly summoned for emergency use, comprise men and women, young and old, from all walks of life.

Not all emergency communication by amateur stations is connected with storms, floods, earthquakes and similar natural disturbances, though the outstanding work has been done in this field of emergency communication. Radio amateurs played their parts in the New England and Mississippi floods and the Florida hurricanes.

When a boy scout camp on Catalina island was quarantined against infantile paralysis, amateur radio became the only means of communication. Neither mails nor telegraph communication were possible. The short-wave amateur station at the camp made contact with an amateur station at Pasadena, kept the parents and friends of over 100 boys and leaders in-



The Equipment That Brought Much of the News When the "Viking" Exploded off Newfoundland; at Right, Elaborate Antenna of Midwest Station

formed as to conditions, summoned medical aid and food.

The first authentic information that the wreck of the sealing vessel "Viking" off Newfoundland had been caused by an explosion of dynamite, came from an amateur operator at Boston. Contact had been established by another Massachusetts amateur with an amateur near the scene of the wreck when the news of the disaster became known. Three Massachusetts stations supplied most of the news and forwarded most of the instructions for the rescue of the sailors.

An amateur in New London, Conn., one night heard the Detroit river lighthouse radiophone calling the United States coast-guard base at Cresenton, Mich. It was a call for help, and the amateur listened, for here was adventure. To his surprise, the call was repeated a number of times, and from the context of the message the coast-guard station appeared not to answer. Finally in desperation the lighthouse sent out a broadcast asking all stations listening to notify the coast guard that a doctor and patrol boat were urgently needed at the isolated lighthouse. New London is a long way from the Detroit river lighthouse, and the amateur telephoned the local coast guard, but they could not pick up the message on their receiver. The Buffalo coast-guard base was notified, and help was sent to the lighthouse.

Group of Western Figures Sculptured by a Montana Youth Who Has Selected Pioneer History of the "Wild" Days as His Motif

FIGURES OF REAL WILD WEST SCULPTURED IN MINIATURE

Realistic miniature sculptures depicting the fast disappearing life of the old west, turned out by a youth not yet twenty years old, are amazing western art lovers. The youth is Earl Heika of Great Falls, Mont., who is said to be the only living sculptor of note giving representation to this period of the nation's history. In a recent group displayed at a fashionable hotel were shown miniatures of cowboys, prospectors, wranglers, pack trains, broncho-busters and covered wagons.

SUNSHINE LAMP FOR CANARIES KEEPS THEM HEALTHIER

Individual "suns" for canaries have been developed by a bird-loving engineer for General Electric, to provide them artificially with the sunshine they obtain naturally in their normal climate. The developer of these individual sun lamps began by equipping his bird cages with ultraviolet lights. The birds seemed to enjoy the radiation, singing and hopping near the lamp. Breeding cages equipped with the lamps showed a greater percentage of hatchable eggs and prevented rickets. The lamps used several hours a day in each cage will supply two birds with sufficient light to maintain their health.

AIR TRIMS TREES AS QUICKLY AS THIRTY MEN

Compressed air operates a pruning machine which will do the work of thirty experts in an orchard and of six of the fastest workmen in the vineyard. The pruner, weighing only four pounds, is built of aluminum with a brass barrel, except for a steel hook and knife. The steel hook is placed over the limb to be cut. The button is pressed to release the compressed air, and the knife is thrown forward, cutting the limb. When the air is shut off, a steel spring draws the knife back to its original position. The pruner is connected with a compressed-air tank on a wagon, on which also is a small engine for compressing the air. An extension pole, reaching fifty feet, eliminates ladders and the time of climbing.

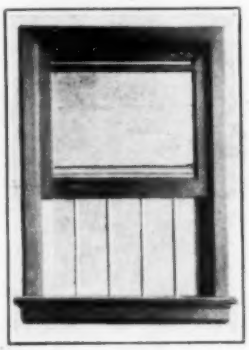
Faster Pruning Is Possible with This Compressed-Air Knife; the Pruner Does the Work of Thirty Men

CLOCK WORKS FIVE CENTURIES RESTS AND STARTS AGAIN

Five centuries of ticking, followed by forty-five years of silence and now at work again—that is the life of the Salisbury cathedral clock, built in 1386, when Richard the Second was king of England. The clock ticked away faithfully until 1884, when a new one was installed and the old one forgotten. But now the old timepiece has been cleaned, adjusted and set to work again. Every part of the clock was handmade from wrought iron. Like many early clocks, it has no face. It strikes the hours, but does not show them on a dial. The oldest clock in England is that in Peterborough cathedral, which was built 611 years ago. This clock has no dial and has to be wound up daily by means of a wooden wheel. An eighty-pound hammer strikes the hours. The Prague clock, built in 1490, was one of the most remarkable in the world. At the hour, two doors opened and the twelve Apostles issued and bowed. Then came the figure of Christ, raising its hands in blessing and then withdrawing. The figure of Death seized the bell rope. A merchant displayed his money bags, a priest held up a mirror to show that all was vanity, and a cock crowed. Then Death pulled the rope and the hour struck.

BURGLAR-PROOF WINDOW BARS SLIDE WITH THE SASH

Open windows are made safe from burglars by an attachment which fits into the lower part of the frame and extends through the sill. It consists of metal rods that raise into place with the lower sash, but slide down grooves into the sill when the window is lowered. In the case of children, the attachment also prevents falls from open windows. The rods cannot be raised out of the sill, due to a lock that holds them in place, while a plunger prevents the upper sash from being lowered.



Propellers Worked by Hand Push This Swimmer Backward or Forward; Note How "Boat" Is Worn

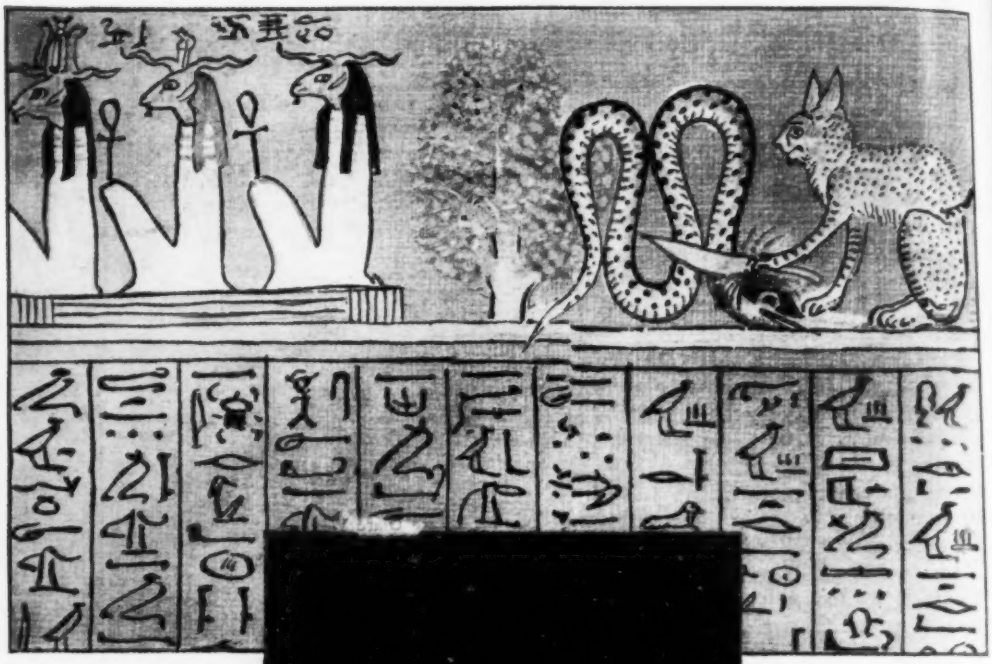
BOAT WORN AROUND THE NECK HELPS IN SWIMMING

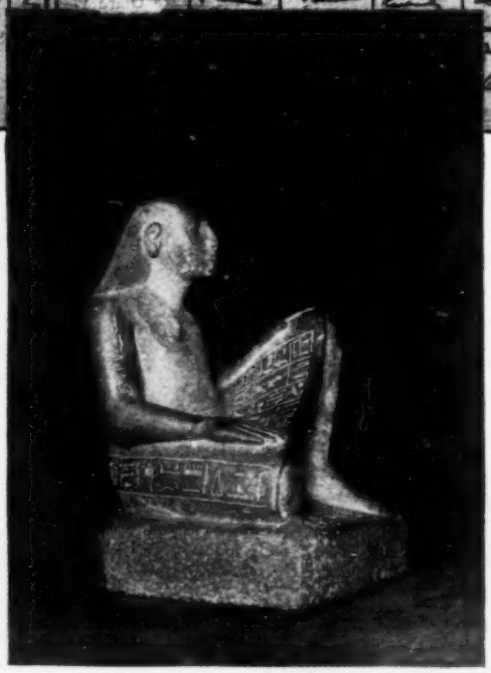
Tiny propellers, turned by two handles on a boat-shaped apparatus worn around the neck, provide a new means of propulsion through the water. A swimmer puts his head through the marine neckband, made of aluminum, and by simply floating and turning the handles, propels himself forward or backward.

STRONGER AND LIGHTER "LEAD" MADE INTO WATER PIPES

Water mains of a new ternary-lead alloy, discovered by a British organization, are being laid in Manchester, England. That the new metal will largely take the place of lead as now used in water piping is a belief freely held. The ternary-lead pipe weighs thirty-three per cent less than lead, has eighty-four per cent more tensile strength and its resistance to vibration, the cause of most water-pipe troubles, is 217 per cent greater than that of the pure metal. The alloy is composed of lead, tin and cadmium and it is said approximately 1,500 pounds of it will give the same footage as a ton of ordinary lead.

World's First Stenographer Found in Egypt





Statue of an Egyptian Who Was Probably the First Stenographer, and Samples of His Work

In the University of Pennsylvania museum is a statue of a man who was probably the world's first public stenographer. The figure is that of an Egyptian who lived some 3,500 years ago and prospered at his work to such an extent that he had a statue of himself erected at his tomb. The stone carving represents the man at work with his papyrus sheets, and it has been found that these early stenographers actually had developed a system of shorthand for taking down dictation which they later transcribed on the papyri that have come down through the ages as a record of the civilization of the times. Some of the ancient stenographer's work consisted of allegorical pictures such as the sacred cat of night cutting off the head of the serpent of day, it being believed that the serpent grew another one during the darkness of the night.

CAR RUNS ON TAR FUEL

Completion of a coal-tar oil product that is said to be a satisfactory substitute for gasoline in internal combustion engines has been announced in Ireland. It is claimed about 500,000 gallons of the fuel can be produced yearly and that the cost of production will be considerably less than the present price of gasoline in Great Britain. In a test with the new

fuel a Belfast bus ran twelve miles to the gallon compared with eight with ordinary gasoline. No loss of power was reported, nor was carbon monoxide present in the engine gases. It also is said the new fuel eliminates engine knocking to a great degree and reduces danger from fire. Its use, however, necessitates some changes in the engine design and the car must be run fifty to a hundred yards on gasoline or benzol before switching to the new fuel.

WHISTLING ON CRUISER ALL BY ONE MAN

Whistling is one of the things that a sailor gives up when he joins the navy. Aboard a battleship one man, and only one, does all the whistling there is to do. The boatswain whistles for the entire crew, and even he is not permitted to do it except on the official pipe. When he blows this whistle it is a signal to the crew translating an order from an officer to do something or stop doing it.

The Boatswain, the Only Man on a Battleship Allowed to Whistle, and His Official Pipe

Doctor Demonstrating "Glarometer" on Another Doctor in Meeting Whe[illegible] Was Blamed for Many Eye Troubles

WAR ON GLARE TO SAVE EYES AIDED BY METER

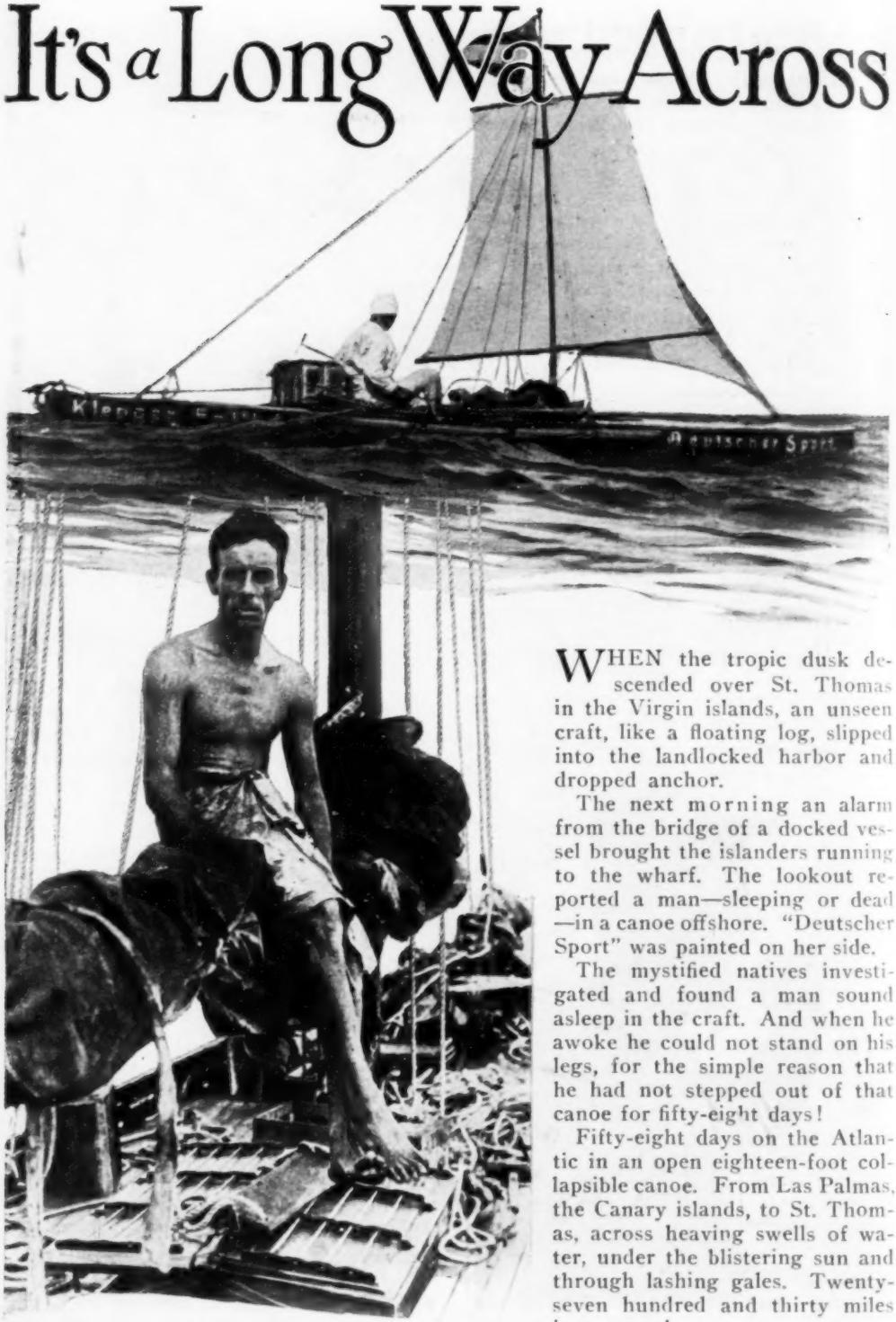
Glare, which optometrists declare responsible for many eye ailments, is the enemy hunted with an apparatus designed by Chicago doctors and exhibited at a recent meeting of specialists at Los Angeles. The device is known as the "glarometer" and tests and measures the effect of natural and artificial glare on the eye by submitting the orb to varying degrees of discomfort and measuring the reaction.

GIANT PACIFIC SUNFISH CAUGHT IN THE ATLANTIC OCEAN

Weighing more than 1,900 pounds, a huge Pacific ocean sunfish was recently caught by commercial fishermen off the coast of New Jersey. It was a struggle for fourteen men to drag the monster from the power-drawn nets into the boat. Officials of the Smithsonian Institution, who arrived to mount and skin the curious creature, said its natural habitat was the central Pacific, and it undoubtedly had made its way around Cape Horn in what they estimated as at least a two-year journey.

¶A rifle cartridge developing high gas pressure is used in Germany for starting airplane motors.

It's a Long Way Across



Top, Capt. Franz Romer Who Disappeared on Lone Voyage to U. S.; Below, Alain Gerbault Who Sailed around World Alone

WHEN the tropic dusk descended over St. Thomas in the Virgin islands, an unseen craft, like a floating log, slipped into the landlocked harbor and dropped anchor.

The next morning an alarm from the bridge of a docked vessel brought the islanders running to the wharf. The lookout reported a man—sleeping or dead—in a canoe offshore. "Deutscher Sport" was painted on her side.

The mystified natives investigated and found a man sound asleep in the craft. And when he awoke he could not stand on his legs, for the simple reason that he had not stepped out of that canoe for fifty-eight days!

Fifty-eight days on the Atlantic in an open eighteen-foot collapsible canoe. From Las Palmas, the Canary islands, to St. Thomas, across heaving swells of water, under the blistering sun and through lashing gales. Twenty-seven hundred and thirty miles in a canoe!

The adventurer's name was

the Atlantic

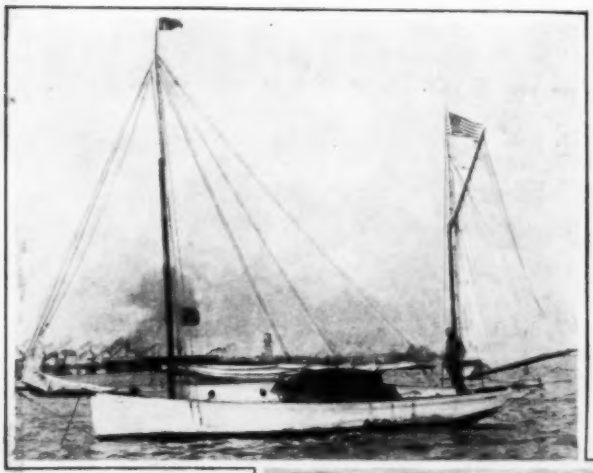
Capt. Franz Romer, age 29, a German aviator and sailor. He had designed and built the "Deutscher Sport," eighteen feet long, eighteen inches deep and only thirty-six inches in the beam. Her frame was covered with rubberized fabric. He could roll up his transatlantic vessel and tuck it under his arm.

When it had cleared Lisbon, Spain, the "Deutscher Sport" was loaded almost to the gunwales. Her skipper had surrounded himself with food and supplies. Gradually he ate his way into the boat so that he could move his legs freely. He taught his canoe how to pilot herself by fastening the sail to the rudder.

Week after week he drove her on. At night he covered his head with a rubberized helmet and buttoned a cape around his throat. He breathed through a respirator.

He carried fifty-five gallons of water and 500 pounds of food. The sun scorched his hands and face. Salt spray ate into his skin. The sharks butted against the hull. Eight steamers thought he was

Top, Gerbault Aboard His Boat, the "Firecrest"; Below, Sloop in Which Two Brothers Traveled 11,000 Miles



adrift and stopped to pick him up. Ha! Not Romer. He was comfortable.

On the fifty-eighth day he sighted the Virgin islands, where he rested before starting for Porto Rico.

"Swim?" Captain Romer said to inquirers, "I can't. What good would that do me?" He cleared San Juan after missing the weather bureau's warning of a forthcoming hurricane. Somewhere between Porto Rico and Santo Domingo the sea claimed him and his canoe.

Captain Romer's adventure ranks among the most daring, but there is an actual record of a life-raft, the "America," consisting of four iron cylinders, crossing the Atlantic, from Southampton to New York, in fifty-two days.

Captain Brudel, of Aalesund, Norway, crossed the North Atlantic in an all-metal boat, eighteen feet long, equipped with a hollow steel mast. He started in June, 1904, and finished in January, 1905, 221 days on the water at a speed of two knots per hour.

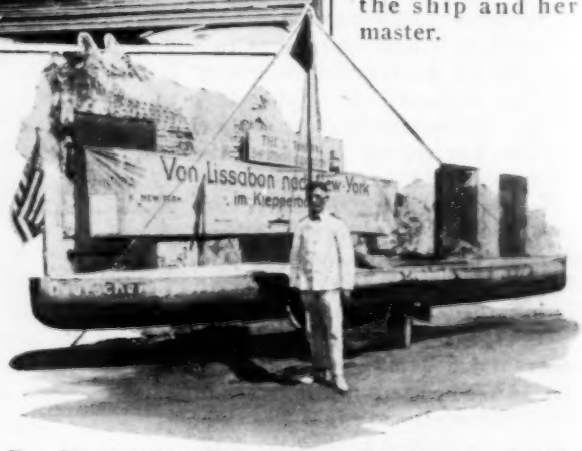
Of all the sixty odd small craft which have made the transatlantic passage, none is more famous than the "Firecrest," which also circumnavigated the globe under the command of her lone owner, Alain Gerbault, a Frenchman.

Gerbault tested his craft in Mediterranean waters. Then he steered for Gibraltar, thence to the open sea.

First, the mainsail began to rip, then the gaff topsail failed to hold. To cap matters, the water went bad. Next the salt beef became unfit to eat. His throat swelled up so that he could not swallow solid food.

A clap of thunder brought on rain for drinking water. Then came the high water. He leaped into the rigging as a battering wave submerged the cutter. The mast groaned, as if she would rip open the deck planks.

But they stuck, the ship and her master.



Top, Boat in Which Harry Pidgeon, in Center, Covered 35,000 Miles; Below, Captain Romer and His Collapsible Boat

Gerbault forfeited his harpoon while trying to spear a fish. His food supply was running low. Day and night the fog blinded him off Nantucket. At length he spied the shore and headed through Long Island sound for New York.

SLOT MACHINES SELL ICE IN SUBURBS

Coin-in-the-slot boxes that dispense twenty-five-pound packages of natural ice cubes, neatly packaged in wrapping paper, stand on the street intersection in busy suburbs of Los Angeles. The boxes are eight feet wide and twelve high and hold 195 packages of ice. A nickel and a dime are inserted in the coin box, a button is pressed, and in seven seconds the folding doors at the lower left of the box open, and a package of ice pops out. The ice itself is cut and sealed without being touched by hands, and the container is serviced from a refrigerator truck.

Coin-in-the-Slot Machine That Vends Cube Ice in Packages of Twenty-Five Pounds

Courtesy Die Woche

Methods of Resuscitating Poison-Gas Victims Are Taught by Using Dummies; Note the Masks Worn by Students in a Factory School in Germany

PREVENTING POISON FROM GAS IS TAUGHT IN SCHOOL

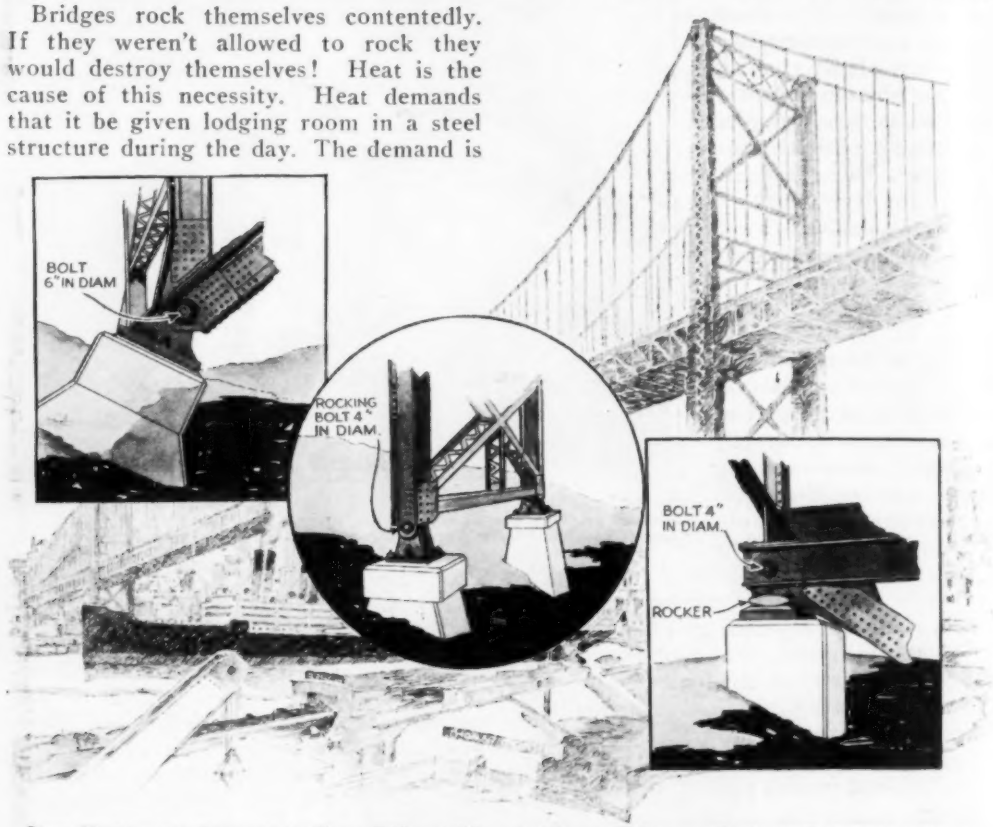
Use of gas masks and the dangers of gas poisoning are taught in a school operated by a German manufacturer in connection with his gas-mask factory. Doctors, sanitary inspectors, firemen and others of similar occupations take part in the courses, while a woman's organization is seeking to enlarge the scope of the school by making the instruction available to the public. Another objective is construction of gas-tight refuges for the public in case of gas attacks from the air.

OIL MADE FROM BY-PRODUCTS AND REFINERY REFUSE

Development of a synthetic motor oil from a base of paraffin wax has been demonstrated by the Standard Oil company of Indiana. Paraffin long has been a "refuse" by-product in the distillation of the crude oil to obtain gasoline, kerosene and the heavier lubricants in which asphaltic bodies, petroleum wax and jelly are left behind. To obtain an ideal lubricant it was found necessary to break up or polymerize the oil, rather than solely to distill it. The new synthetic oils can be made in any viscosity, are of a pale straw color and are said to be highly resistant to oxidation and sludging.

Bridges on Rockers Give Heat Elbow Room

Bridges rock themselves contentedly. If they weren't allowed to rock they would destroy themselves! Heat is the cause of this necessity. Heat demands that it be given lodging room in a steel structure during the day. The demand is



Inset Photographs Demonstrate Three Different Ways to Mount Bridges on Rockers; Each Is Applied to Particular Formations of the Earth at the Point the Bridge Is Built

for an increase of only .00009 of an inch for each foot of steel that is increased in temperature one degree. What would happen if the engineers ignored this demand? In a structure with a span of 650 feet, a change of about sixty degrees would expand it approximately three and one-fourth inches. Heat upon entering would demand three and one-fourth inches in which to stretch, and if the bridge were not free to rock, tremendous stresses would develop that would crush the concrete abutments or crumple the steel girders. Locating the bridge ends, the foundations, centering the rockers, and providing extra pivots throughout the structure call for field work of the most exacting nature. Even the expansion of the measuring tape is taken into account by reading a thermometer when the tape is read. One reading might be wrong, so four readings are taken of the same distance. Think of the care exercised in designing a bridge of thousands of pieces. Then you can imagine the satisfaction of the men responsible when the last section of the arc is hoisted into place and the rivet holes line up perfectly. One engineer watched the opposite ends of a bridge he had designed approach each other, then sailed for Europe. But the final section was several inches too large. The delay of building a new central section was impossible, as the contract was about to expire. The contractors cabled the engineer. What should they do? The reply came back, "That bridge is designed to fit! Put ice on it!" Tons of ice were placed, and slowly the heat left and the two halves contracted. The central section slid into place. They had made the bridge rock itself.

AIR SICKNESS "OUT OF FASHION" SO THE MALADY WANES

Air sickness in America is passing, according to surveys by pilots, co-pilots and air-line attaches. Most students of the subject have agreed that the biggest reason for the decline is the increasing travel by airways, with consequent decrease in nervousness on the part of passengers. Air travel has now become so common that air sickness has gone out of style. Most authorities agree that there exists no sound physical reason for air sickness, except in "bumpy" weather, as the motion of the airplane is quite different from that of a ship, since the latter rolls and tosses continuously from the time it leaves one port until it arrives at another. In the air, on the other hand, there is none of this rolling, except when the air is upset by storms. It long has been held by air-line operators that air sickness is caused about ninety per cent from nervousness and ten per cent from motion of the plane. It also is believed that better ventilation of ships is partly responsible for the change.

With Snips and Soldering Iron, a Sheet-Metal Worker in Twelve Hours Evolved This Example of Modernistic Art—a Twelve-Foot Man Astride His Tin Horse

BUCKLE FOR FASTENING ROPES REPLACES UNHANDY KNOTS

Tiresome and unhandy knotting of ropes is eliminated by a simple rope buckle now on the market. The buckle is made of six-gauge special steel wire. Open prongs in which the rope end is placed are closed with a hammer, taking only a few seconds to make a tie rope which is handy for tourists and farmers.

¶Complete ventilation of airplane cabins is being provided by slip-stream suction.

TIN MASTERPIECE AS A SIGN PROVES WORKER'S SKILL

Just to show his skill with snips and soldering iron, a sheet-metal worker of Long Beach, Calif., constructed a tin statue of a modernistic man on a horse. The twelve-foot figure was put together in only twelve hours, then placed in front of the artist's shop to attract attention to his working ability.

MILK PRODUCTION IS AFFECTED BY CHANGES IN WEATHER

Changes in temperature have a definite effect upon the milk production of cows. This was shown by recent experiments at the University of California, where it was found that both the quality and quantity of milk given by Jersey cows were affected as the temperature rose. Two cows were kept in a room with temperature carefully regulated for forty-five days, and the milk production fell off as much as thirty per cent in five days as the temperature was raised.

COFFEE-URN WATER SOFTENER CUTS FUEL COSTS

Water Softener Helps to Reduce Costs of Operating Coffee Urn by Removing Minerals

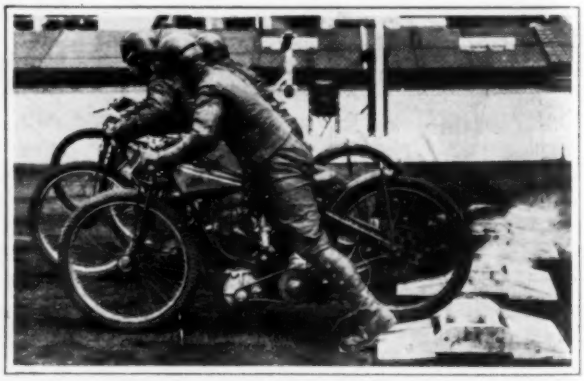
All lime is removed from water used in coffee urns by a water softener now on the market. Considerable saving on operating and maintenance costs is claimed. The accumulation of lime on the interior of urns, say the makers of the softener, causes increasing fuel expense, scoring of valves and faucets, burning out of bottoms and decreased capacity, which results in inaccurate water-gauge measurements. The softener operates on a principle of simple chemical reaction, with common table salt used as the medium of regeneration.

HOW ELECTRONS MOVE IS SHOWN BY X-RAY

Recent completion of a prism spectograph and experiments with it have proved the effects of an X-ray on the electrons within an atom. Two scientists of the California Institute of Technology say the device which they made has established that there is electronic motion within the atom, the X-ray acting on the electrons like a billiard ball rolled violently into the midst of other billiard balls. The theory was conceived several years ago and the fifty-crystal prism spectograph, with every prism fixed on a single line in the spectrum, was constructed to determine its truth. It was assumed that X-ray waves are scattered by electrons, and that as the scattering angle is increased, a broader line would be cast by the X-ray spectrum, a narrow angle resulting in a narrower line. The instrument, the scientists declare, has proved both theories. It is so delicately adjusted that the spectrum cast by the fifty prisms can be so superimposed that all the lines fall exactly on the same place on a photographic plate. This was necessary in order to make the delicate measurements and calculations essential to proof of the theory.

MOTORCYCLE RACE IS STARTED BY ROLLERS UNDER WHEELS

British motorcycle racers are getting away on even terms by using automatic starters. Each starter consists of a frame supporting two rollers on which the rear wheel of the motorcycle is placed. This enables the machine to be started, the drive wheel revolving on the rollers until the signal to start is given when the wheels are pushed off the tracks simultaneously and the racers get away neck and neck.



Rollers under Rear Wheels Used as Automatic Starters to Enable Motorcycle Racers to Get Away Together

You Can See Out but Not In with This Glass

Showing How Glass Is Translucent from Inside and Opaque, Reflecting Images Like a Mirror, from the Outside

Glass that is opaque from the outside recently was demonstrated in the windows and windshield of an automobile. Passengers and driver can see perfectly from the inside of the car, but the appearance from the outside is that of a mirror. The only difference from ordinary glass from the inside is a slight bluish tinge. The glass also permits the passage of ultraviolet rays.

AIRCRAFT GUARD FOR FORESTS PROTECTS AGAINST FIRE

Airplanes are being employed by the United States forest service to guard against the danger of fire in Michigan forests. Two planes are on duty, patrolling four national forests in the state, while other planes of the company holding the patrol contract are subject to call when visibility is so poor that fire towers are useless or when fires are so extensive that present methods of observation are ineffective. Aircraft are being used to fight mosquitoes in New Jersey, scouts being placed on duty to locate bodies of water and marshland areas where the pests breed. The planes carry maps showing all natural bodies of water, and when an uncharted body of water is located, the plane descends to within 300 feet to inspect. In early tests, a plane scouted 220,000 acres of marshland in six flying hours, a task at which forty men on the ground would be kept busy a week.

PORTABLE SHORT-WAVE SENDER AIDS SPORTS BROADCASTS

Portable Radio Transmitter and Receiver Which Allows Golf Broadcasts Stroke by Stroke

A complete radio plant that you can carry around on your back has been developed by engineers of the National Broadcasting company and received its initial try-out in broadcasting the American open golf championship tournament. It is built in two units, the transmitter being carried by a helper, and the receiver mounted on a pole which also serves as the antenna.

WATER RUNS ENGINE CHEAPLY AND WITH MORE POWER

Operating without boilers or condensers, an engine which runs on water instead of steam is being offered for experimental commercial use in England. Expansion of water operates the engine, the water being heated rapidly in one cylinder and cooled in the other to cause a movement against pistons connected to the same shaft. Cheapness of operation and production of more power in less space than ordinary steam and gas engines, are two claims of the inventor. Only a small quantity of water is needed. The mechanism is simple, and the working parts need be opened for inspection only once in four years. It loses less heat than other engines and its outside shell is cool to the touch. The engine has no exhaust, the water being used over and over. All bearings are cold and lubricated by the water itself. For an engine of this type with a rating of 100 horsepower or over, the indicated efficiency as measured by three different engineers was twenty-seven per cent. In comparison, a steam engine of the same class was rated at only eight per cent, and a gas engine at fourteen and seven-tenths per cent. The engineers said the efficiency of the water engine would increase with the size. The weight and cost of this engine are about the same as those of a steam engine, but the inventor says, the liquid engine locomotive can give the same power at half the coal consumption and none whatever of water.

PLANE WITH "CLIPPED" WINGS TRAINS STUDENT PILOTS

Fledgling flyers at one New York airport learn the rudiments of handling an airplane without leaving the ground by practicing in a small ship with stubby wings and powered with a two-cylinder motorcycle engine. This trainer can be taxied about the field and lifts its tail as though about to take off, but has neither the power nor the wing spread to leave the ground. The student pilot cannot even "nose over," because there is a safety wheel and frame in front to prevent such an accident.

Plane with Stubby Wings and a Small Motor for Training Students; Note Safety Wheel in Front

With DEATH *as a* SPECTATOR

THEY PRY *apart* BOMBS

© P. A.

Taking Apart an Infernal Machine; at Left, Typical Pipe Bombs Containing Nitroglycerin and Concrete

LITTLE Negroes who used to sit on safety valves on the Mississippi river steamboats had an easy time compared with the members of metropolitan police forces who are specialists on the disintegration of bombs.

These experts are indispensable to the police in running down makers of bombs and infernal machines. The bravest officer may prove himself absolutely fearless snuffing out a fuse leading to a bomb, but when it comes to handling the bomb and examining its makeup for possible clues, he may wish himself elsewhere.

The responsibility of dealing with bombs in an intimate manner is the special duty of the bomb expert. Bombs are his business. He knows them all, and he doesn't care how large and dangerous they are or how diminutive and innocent, for they all go the same way.

When you ask one of these experts what would happen if one of the packages of death should blow up, he'll probably say nonchalantly:

"You'll be able to tell when it happened by my watch!"

Every unexploded bomb is carefully examined for characteristics which are expected to reveal the identity of the maker. No two bombs are exactly identical, but the expert can tell at a glance if they are the handiwork of a novice or of a master workman. Most bombs are of dynamite—simply constructed affairs, consisting of two or more sticks of surface-blasting gelatine tied firmly together.

A study of 145 bombs revealed that eighty per cent of them were made by the same group of persons.

Occasionally, however, the police come

© P. A.

A Huge Police Seizure of Bombs, Guns and Ammunition; Pipe and "Pineapple" Bombs Made Up the Greater Part of the Infernal Collection

upon an infernal machine which is as cleverly designed as it is dangerous. The expert delegated to report on the workmanship of such devices is literally taking death in his hands. The only way to ascertain the mechanism and constituents of an infernal machine is to dig, scratch and pry apart what some fiend has put together to destroy. One wrong move means another star on the board.

Few persons engaged in this work ever escape uninjured. The dean of them all is the late Owen Eagan, of New York, who was inspector of infernal machines. In his twenty-one years of uninterrupted duty, he furnished clues that ran down the makers and placers of 7,000 bombs. Only once in that long period of service did a bomb explode in his hand. That one was a cunningly contrived instrument of death.

Eagan was called to the apartments of Judge Otto Rosalsky, in New York. On the judge's library table lay a neat package wrapped in yellow paper, about five inches square and three and a half inches high. It looked like a box of candy and was handed to one of the maids of the house by a young man who made no comment. The judge was about to open it, when his better judgment told him not to.

After Eagan had looked at the box intently and had pressed his face close to it to smell it and listen for any mechanism that might be at work, he cut the string and unwrapped the paper. Within, there was a box of white pasteboard.

With caution he lifted the cover and noticed that it resisted a little. This sticking of the cover on so frail a box aroused his suspicion.

"It acts like a real one," he said. "You'd better get out."

Leaning backward with his face partly turned away, he stretched out his arm and gingerly lifted the cover. Little by little he raised it until he could slide it off.

The opened box revealed a piece of iron pipe an inch in diameter with an elbow in it. On each side of it was a small dry battery, connected by wires with a fulminating cap. Lying on top of the apparatus was a small package done up in tissue paper.

On the underside of the cover, near the center, was glued a small piece of cork, apparently a buffer. Another buffer was glued to one of the corners of the cover.

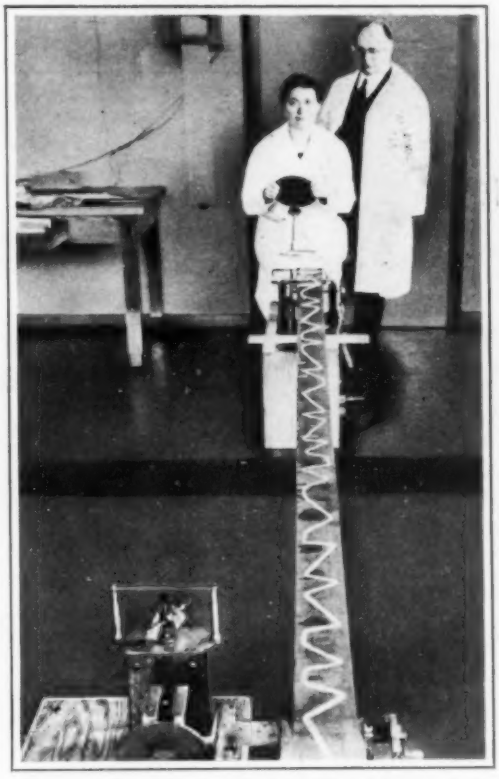
Carefully picking up the small package of powder, he laid it on the table. Then he took out a jackknife and cutting down one edge of the box, he started to cut down the edge of the other side. Instantly there was a blinding flash and explosion. He lost the index finger of his left hand and four fingers of his right hand were rendered permanently numb. Particles of steel were imbedded in his right cheek and eyelid, and he carried them to his death.

LIZARD HAS FRILL ON ITS NECK TO FRIGHTEN ENEMIES

When angered, a rare Queensland lizard opens out a large capelike frill from its neck and distends its jaws. The frill is a foot wide and is draped over the lizard's shoulders like an Elizabethan cape when the reptile is aroused. At rest, the lizard looks like any other.

Frilled Lizard Shown with Cape Spread and Mouth Opened Wide to Terrify Enemies

HOW MUCH WORK MAN CAN DO IS SHOWN BY BODY TESTS



Woman Turns Wheel to Follow White Lines on Laboratory Equipment Which Tests Body's Reactions

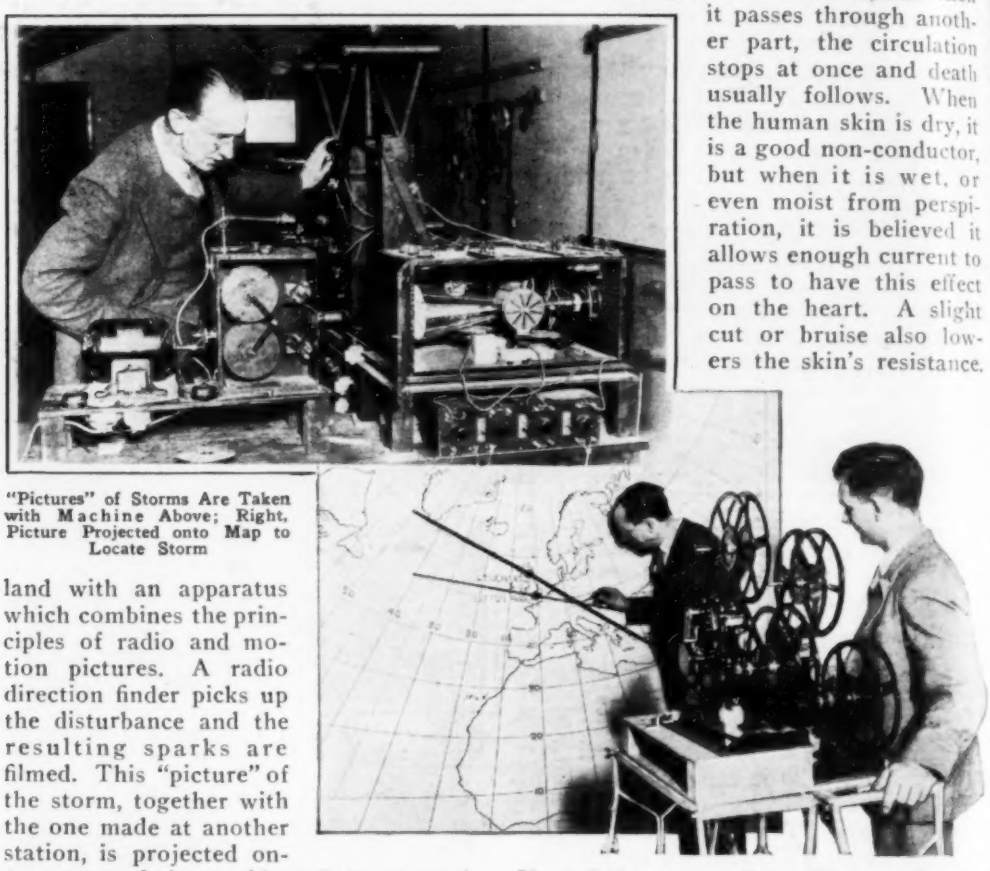
Conditions under which the body of man will give the maximum output of work while expending the minimum of energy are determined by experiments being conducted in Germany. The tests also are to show how fatigue can be staved off to the extreme limit.

LUMPS OF COAL TRADE-MARKED

In order to standardize its product, one coal company is giving each lump of coal it sells a distinctive marking. The coal from the mine is passed along a trough conveyor, coming in contact with metal arms placed perpendicularly across the width of the conveyor. At the end of each arm is a shoe which rides over the lump of coal. As long as the shoe is in contact with the lump, the valve to a pressure gun is open and the lump receives a neat band of bright paint.

RADIO SNAPS STORM PICTURES TO HELP WEATHERMAN

Film records of distant thunderstorms are taken at stations in England and Scotland with an apparatus which combines the principles of radio and motion pictures. A radio direction finder picks up the disturbance and the resulting sparks are filmed. This "picture" of the storm, together with the one made at another station, is projected onto a map of the world, and the storm is located at the intersection of the direction lines.



"Pictures" of Storms Are Taken with Machine Above; Right, Picture Projected onto Map to Locate Storm

LOW-VOLTAGE ELECTRIC SHOCK IS EXTREMELY DANGEROUS

Electric shock of even such low voltage as that found in house circuits is extremely dangerous and may cause death. Heretofore, when people died from shocks supposedly from low-voltage lines, it was thought that the voltage had suddenly become greater. A recent report to the American Medical association, however, advances the explanation that electricity under the pressure of a very low potential affects the heart, causing a tremor or wavering. Instead of all the muscle fibers contracting together, they each do so separately without co-ordination. When the current passes through one part of the heart this "fibrillation" occurs without interfering with circulation, but when it passes through another part, the circulation stops at once and death usually follows. When the human skin is dry, it is a good non-conductor, but when it is wet, or even moist from perspiration, it is believed it allows enough current to pass to have this effect on the heart. A slight cut or bruise also lowers the skin's resistance. Household power lines customarily are grounded on one side and contact between the other side and any part of the body becomes dangerous when the skin is wet enough to conduct. Pipes, radiators, sinks and conduits in which power wires run usually are well grounded, and this, together with the fibrillation theory, explains the numerous cases of fatal electric shocks to persons touching electric appliances while in the bathtub, for instance. It also may be dangerous to touch electric lamps with wet hands, especially when there are cuts and abrasions of the skin. Another danger spot is the chain-pull switch, and a safe practice is to attach a piece of silk ribbon to the chain, particularly in the bathroom, kitchen and cellar.

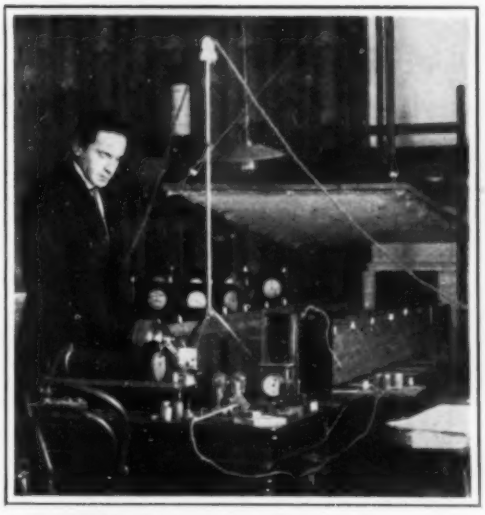
ELECTRIC "EYE" WATCHES SUN AND LIGHTS UP STREETS

When darkness approaches, a tiny electric "eye" automatically turns on street lights in nine circuits of the system at Albany, N. Y. Regardless of the hour, a certain degree of darkness acts on the photo-electric cell, operating a relay which in turn supplies power to throw a switch turning on the lights. During the period of darkness, contact is maintained and the lights remain on, but as soon as daylight reappears, the contact is broken and the switch opens, turning off the lights. The eye is turned to the north so it sees only the average light and thus avoids direct sunlight. Time-delay relays are included in the equipment to prevent instantaneous operation in response to passage of a cloud over the sun, a flash of lightning at night or a person walking in front of the unit, but once the contactor has been actuated, it will remain and not flutter at the critical light intensity. The only factors governing the control unit are light and darkness.

TINY SIDECAR MOTORCYCLE CARRIES TWO CHILDREN

One of the latest and most popular vehicles for children in Europe is a tiny motorcycle that is equipped with a sidecar to provide room for an extra passenger. Youthful riders on these racers stage exciting speed contests.

Tiny Motorless Cycles, Equipped with Sidecar, Are Used by German Children in Thrilling Races; Three Wheels Give the Machines Stability



© Press-Cliche
Apparatus That Produces Artificial Ionization of Air Which Has Been Found to Affect Health

IONIZATION OF AIR INFLUENCES HEALTH OF ANIMALS

Artificial ionization of the air has been found to have a definite effect on the health and well-being of animals. Prof. A. L. Chizhevsky, European scientist, recently summarized the results of ten years of experiments with ionized air on organisms. He said he had established that positive ionization in certain doses produces unfavorable physiological effects, while negative ionization resulted in contrary effects, animals subjected to the latter form growing more rapidly and showing extraordinary virility. Ionized air has been used in the treatment of humans suffering with lung diseases with favorable results, and in general it has been found that negatively ionized air is stimulating and helps to defeat disease. Ionization of air also is being applied to agriculture, and chickens have been found to thrive better and grow faster under its influence.

¶The United States imports most of its sunflower seed and oil from Russia, Ukraine and Rumania.

Hide-and-Seek

By BOB BECKER

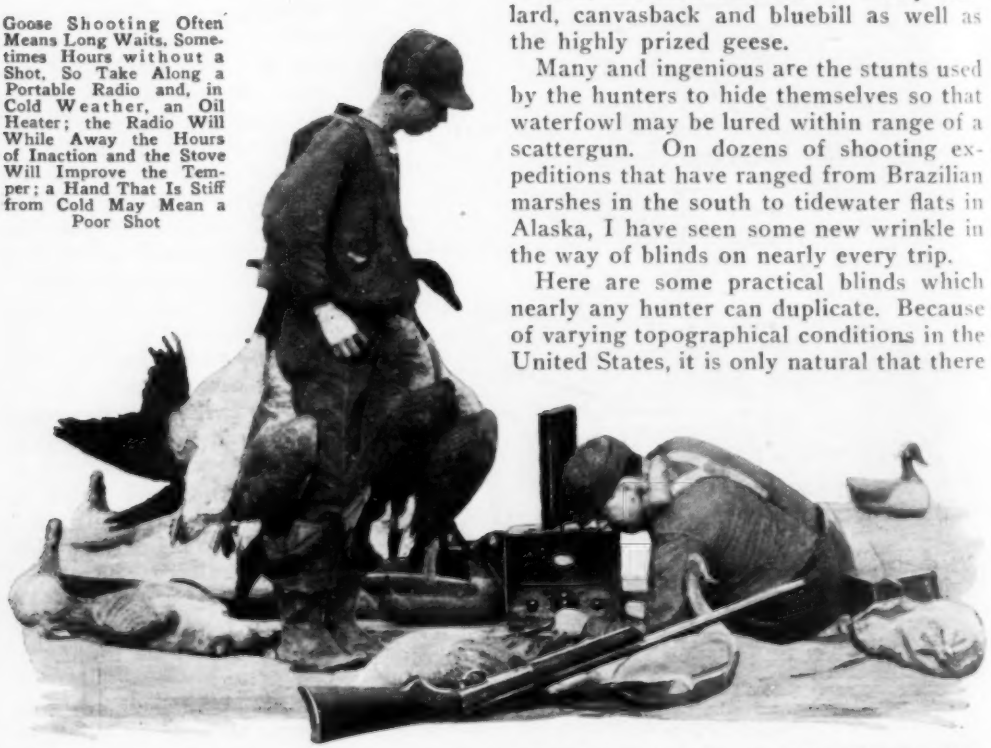
NOW that autumn is here and countless hordes of waterfowl are winging their way southward for the winter, more than 7,000,000 hunters are thinking of shotguns and a hide-and-seek game with the ducks and geese.

The hide-and-seek part of this sport is found in the fact that the waterfowl hunter must take up the art of making blinds or hideouts, learn how to secrete himself in marsh, slough or on the edge of pond or lake, and then wait out the crafty mallard, canvasback and bluebill as well as the highly prized geese.

Many and ingenious are the stunts used by the hunters to hide themselves so that waterfowl may be lured within range of a scattergun. On dozens of shooting expeditions that have ranged from Brazilian marshes in the south to tidewater flats in Alaska, I have seen some new wrinkle in the way of blinds on nearly every trip.

Here are some practical blinds which nearly any hunter can duplicate. Because of varying topographical conditions in the United States, it is only natural that there

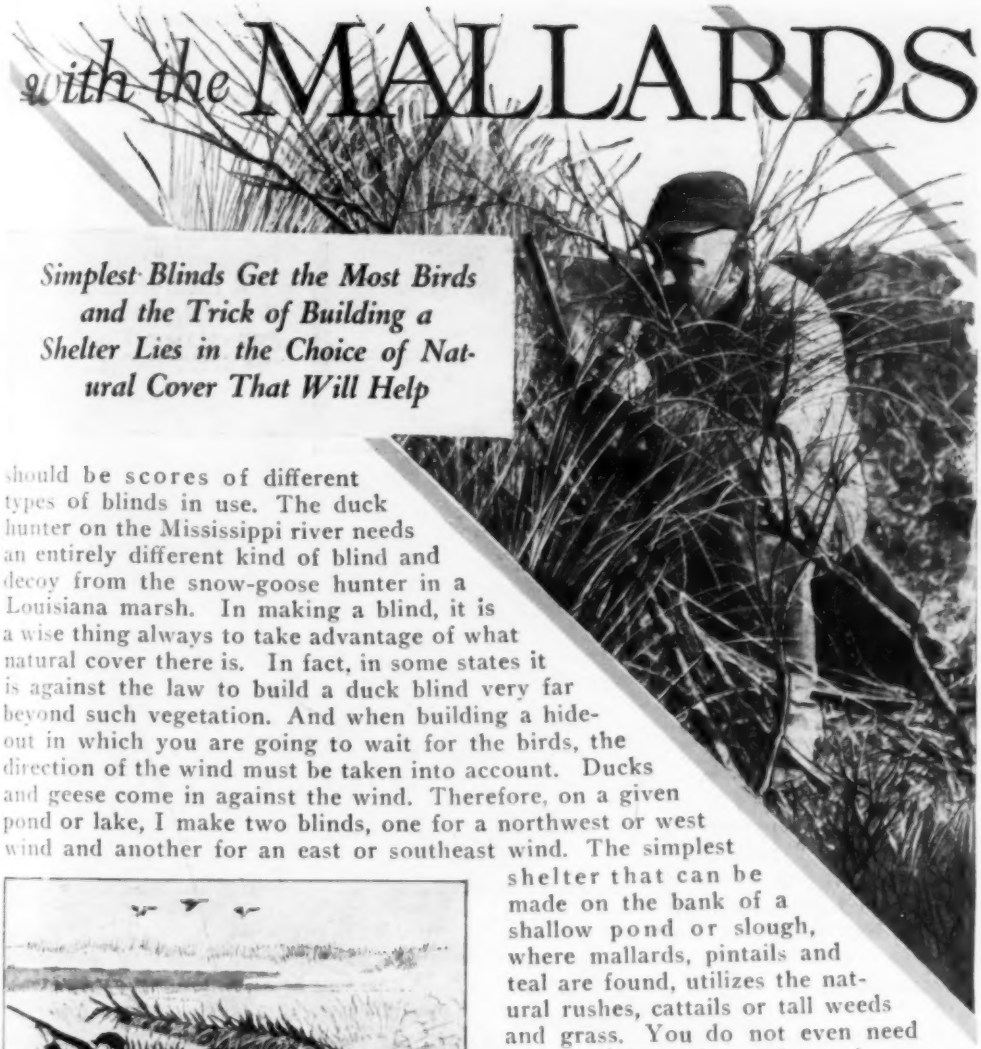
Goose Shooting Often Means Long Waits, Sometimes Hours without a Shot, So Take Along a Portable Radio and, in Cold Weather, an Oil Heater; the Radio Will While Away the Hours of Inaction and the Stove Will Improve the Temper; a Hand That Is Stiff from Cold May Mean a Poor Shot



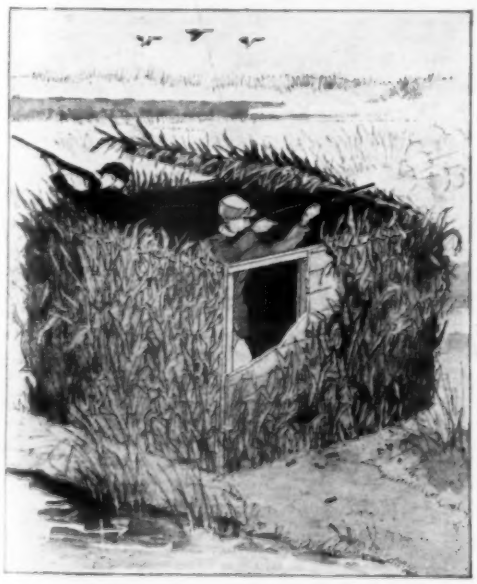
A Willow, Wire and Frame Blind, a Common Type for Timber Shooting, Above, in Circle; Below, Getting World's Series Results after a Successful Day with the Honkers

with the MALLARDS

Simplest Blinds Get the Most Birds and the Trick of Building a Shelter Lies in the Choice of Natural Cover That Will Help



should be scores of different types of blinds in use. The duck hunter on the Mississippi river needs an entirely different kind of blind and decoy from the snow-goose hunter in a Louisiana marsh. In making a blind, it is a wise thing always to take advantage of what natural cover there is. In fact, in some states it is against the law to build a duck blind very far beyond such vegetation. And when building a hideout in which you are going to wait for the birds, the direction of the wind must be taken into account. Ducks and geese come in against the wind. Therefore, on a given pond or lake, I make two blinds, one for a northwest or west wind and another for an east or southeast wind. The simplest shelter that can be made on the bank of a shallow pond or slough, where mallards, pintails and teal are found, utilizes the natural rushes, cattails or tall weeds and grass. You do not even need wire to make such a shelter unless you expect to use it many times. Last fall I picked out a stand of smartweed at the edge of a shallow pond and had excellent teal shooting from this crude hideout which also hid my retriever. The main thing is to sit still when birds are circling. Just a little cover will suffice if the hunter will avoid squirming around when they are near.



Permanent Blind of Wood with Grass or Cornstalks Threaded through Wire Loops to Cover It

If your cover is thin, the addition of a few branches, weeds or bundles of grass will help. However, watch this point when you are shooting from behind a thin blind; don't let the birds circle too much, or they may spot you.

To obtain more comfort, especially in

Mallard Decoy Silhouettes Cut Out of Wood for Ice Shooting Late in Season, Above; Making a Blind in Ice with Grass and Wire, Below

boat, I have been forced to rig up a blind whenever a shoot was desired, because the flood water had covered all the good blinds.

Before you start out to make this blind, get pieces of ordinary wire (hay wire will do) and tack them to the side of the boat, either to the gunwale or flush with the deck. Bulge the wire so that it stands out in a small loop every few inches. These loops are to hold cover. When you have located a good shooting spot where ducks are working, throw out your decoys and then cut big bundles of vegetation growing at the edge of the water. Get plenty and pile it in the boat.

Now you are ready to shove your duck boat into the weeds near your decoys. As soon as you are located, thread this cut grass into the wire loops around your boat until you have a complete ring around you. Cover the decks with the same material.

But don't let this cover stand too high above the boat. It will not look natural. If you sit down on the bottom of the boat, keep quiet when ducks are working, and shoot from a sitting position; you can get plenty of birds. If they are fairly shy, I toss some of the grass across the boat, too, so they cannot get a good look

cold, windy or rainy weather, the sportsman can go one step further by making blinds of wood and covering them with bundles of grass and vegetation. These should be constructed in sections which hook together, and set up among tall wild sunflowers and weeds growing on the bank of a pond. A roof, covered with waterproof material, can be placed over these, so that you can sit back in the blind and keep out of the rain. In front there is sufficient opening between the roof top and the lower part of the blind to permit you to watch the sky for birds.

Rows of wire tacked on the blind, with open loops of this wire sticking out, make it possible to attach small bundles of weeds and grass to the top and sides, thus making the hideout effective. All weeds and grass around it should be left untouched. A small door at the side provides entrance. These blinds are not expensive, fit into the vegetation nicely and are worth their weight in gold when the weather is uncomfortable.

It's surprising how easy it is to make a serviceable blind out of almost nothing, providing the hunter will use his head in placing it and sit still when birds are working. For example, in high water when it is necessary to use a little duck

In Circle: "I Was Hunting a Country Where Snow Geese Were Found; When It Came Time to Put Out Decoys, I Noticed the Guide Had Few Blocks and Fewer Live Birds, but He Had Lots of Newspapers; with These He Made Decoys in Just a Few Minutes; the Articles Required Were Papers, Short Sticks and Plenty of String; Ramming a Stick into the Soft Marsh so It Stood Upright About a Foot, He Tied a Sheet of Paper to It; Then He Pulled It Out and Staked Two Corners of the Paper; the Finished Decoy Looked Silly, but It Worked; Snow Geese Came to Them Perfectly."

Action in a Goose Pit on a Bar, at Top; a Pulley on a Stake, About Twenty Feet Out in the Water, Lets You String Live Decoys from Your Hideout without Getting Wet

Natural Color, Above; Below, a Little Camouflage Is Enough if You Sit Still While Birds Work

at the open length of it. If the hunting is in low buck brush at the edge of the timber, cut large bundles of willow branches and arrange them the same way. I have made them even without wire.

One of the most comfortable blinds for timber shooting, where the water is so deep that you must use a boat to get to the hideout and also to retrieve your birds, is the "floater" with a boat compartment. Three big logs form the base of the blind, which should be placed in a clump of willows or trees so that it blends into the background.

A floor is nailed across two of the logs in front and then willow branches, small dead twigs, and other similar material, are nailed to the blind to make enough cover to hide behind. A long comfortable seat and back also can be placed in it. Immediately behind the seat, leave an opening large enough for your duck boat so it can be slid into the blind and hidden from the birds.

An adaptation of this type of brush blind (a permanent blind) is that which is constructed over a framework of chicken wire and is long and narrow, just wide enough for a duck boat.

The blind is the length of the standard boat. The framework is set up in two parts. Both the front and back sections are as wide as the boat at the base and slope toward the middle so that just enough of an opening is left at the top for the hunter to stand up and shoot. You run your boat into this and then squat on a shell box. Both front and back are covered with branches, if you are in timber, or with grass if in a fairly open marsh.

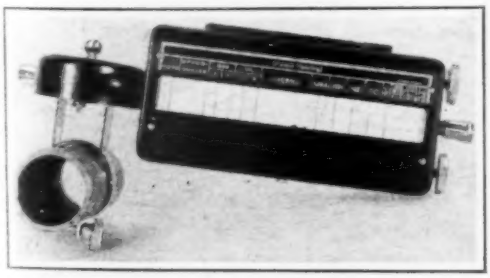
Last fall, when cold weather had put ice on a broad shallow marsh covered with smartweed where I was hunting, the birds were working to a couple of open holes in this area. My partner took his duck boat, a push pole, some chicken wire, two live hen-mallard decoys and a duck caller, and walked to the middle of the slough. There was no blind there.

He found a muskrat house near a pool which had been kept open by the birds. This gave him an idea. Leaving his boat, he cut bundles of smartweed, assembled the material at the muskrat house, which was built around a log. Sitting on the log, he placed his chicken wire around him, threaded the weeds into it, set out his decoys, leaned against the rat house and started his duck caller. By keeping perfectly still, he killed his limit in one hour and twenty minutes in spite of the fact that at no time was he completely hidden from view.

Even Lions Object to Aching Teeth, So a Dentist and His Assistant Are Treating "Jimmy," a Movie Lion

AUTO COSTS QUICKLY COUNTED ON AUTOMATIC RECORD

Cost of operating an automobile can be computed quickly by the use of an automatic bookkeeper, which can be attached to steering post. The device turns down out of the way when not in use. An automatic light illuminates the record as the driver writes.



Automatic Bookkeeper for Computing Costs of Auto Operation Attached to Steering Post

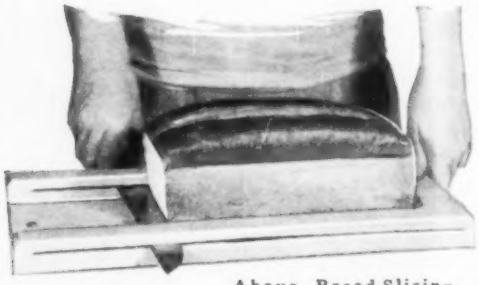
DENTIST GOES INTO LION'S DEN AND TREATS BAD TOOTH

When "Jimmy," one of the movie lions, developed a toothache, he raised a rumpus. His feline companions joined in the uproar. Finally it was necessary to call the dentist.

RADIO ROBOT STEERS WARSHIP DOING WORK OF SIXTY MEN

Manned entirely by radio, a crewless navy destroyer was put through maneuvers at high speed off the Pacific coast recently to demonstrate the practicability of running a fighting ship without a man aboard. Among other things, the vessel made a 180-degree turn, no easy trick even for a well-trained crew. The destroyer run by a radio robot was the decommissioned U. S. S. "Stoddert," a 195-foot vessel of 1,500 tons, and everything from its whistle to its rudder was controlled by radio from the bridge of another destroyer following in its wake. The control panel consisted of a little box containing eight keys, resembling those of a typewriter, and by manipulating these keys, one sailor was able to do the work of a crew of sixty men. Part of the time the vessel was making twenty-six knots or about thirty miles an hour.

NEW CONVENIENCES

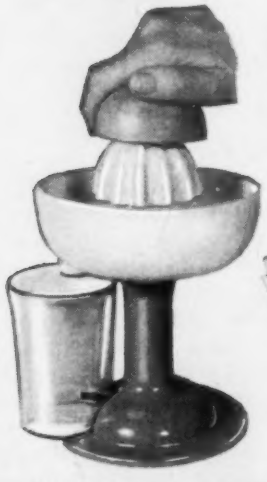


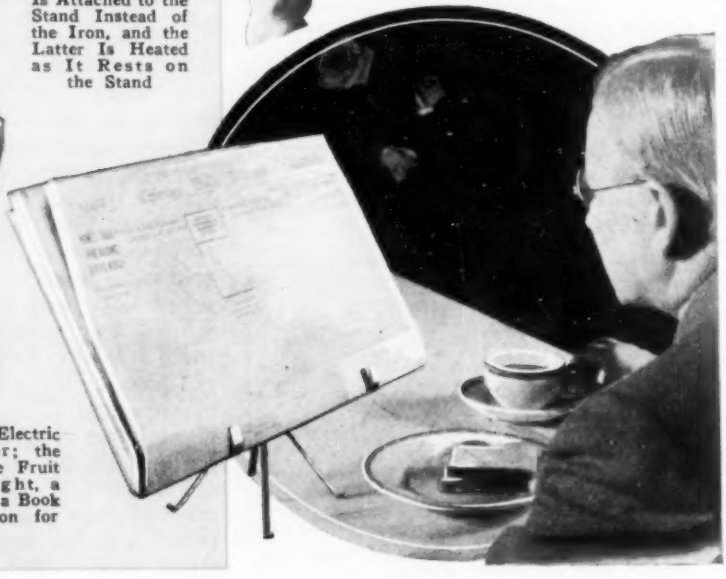
Above, Bread-Slicing Board to Make Lengthwise Cuts for Ribbon Sandwiches; It Can Also Be Used for Cutting Vegetables

Above, Knife Sharpener That Puts Edge on Blade as It Is Drawn through the Slot

Left, Colored-Enamel Wall-Switch Plate in Hues to Match Walls

Above, Cordless Electric Flatiron That Allows More Freedom in Operation; the Cord Is Attached to the Stand Instead of the Iron, and the Latter Is Heated as It Rests on the Stand

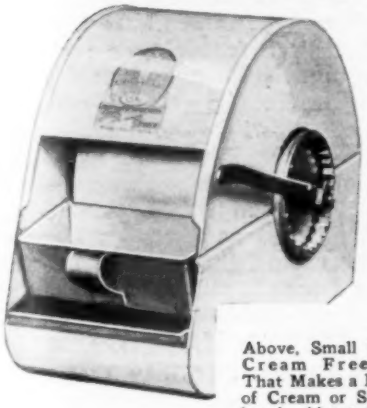




Above, Automatic Non-Electric Fruit-Juice Extractor; the Reamer Turns When the Fruit Is Pressed onto It; Right, a Handy Rack for Holding a Book or Newspaper in Position for Reading

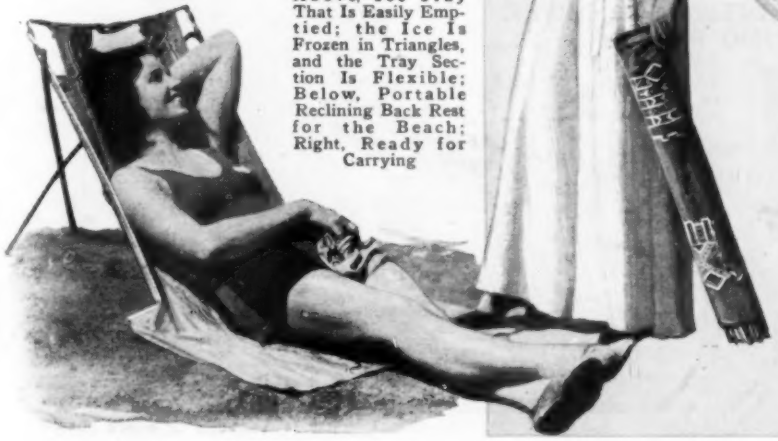
for YOUR HOME

Above, Manicure Set in Tube Like Fountain Pen; It Consists of Cuticle Stick, File and Brush

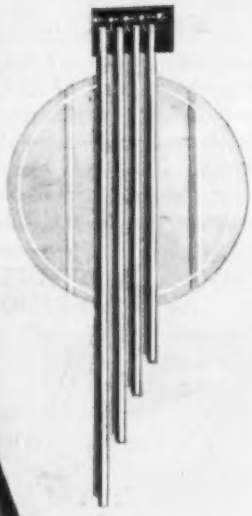


Above, Small Ice-Cream Freezer That Makes a Pint of Cream or Sherbet in About One Minute

Above, Portable Two-Legged Folding Writing Table That Rests on the Floor and on the Lap



Above, Ice Tray That Is Easily Emptied; the Ice Is Frozen in Triangles, and the Tray Section Is Flexible; Below, Portable Reclining Back Rest for the Beach; Right, Ready for Carrying



Above, Electric Chimes to Replace Doorbell in Announcing Callers; the Chimes Sound in Different Sequence Each Time

Shower Which Can Be Set Up on Lawn; Note How Hose Is Plugged In at Base

SHOWER SET UP ON THE LAWN KEEPS EVERYBODY COOL

Cooling showers may be enjoyed every hot day by using a lawn shower which comes in three sections, sets up in your front yard and comes apart for easy carrying. The lawn hose is attached at the base, through which small stakes are hammered for steadying.

IRON HAS QUALITIES OF COPPER AFTER BEING PURIFIED

Many qualities of copper are found in iron purified by a German process. There are two steps in the process, the first driving out most of the impurities and leaving the iron in a finely powdered form, and the second changing this powder into solid form by heating to 1,200 degrees Centigrade, twelve times as hot as boiling water. This leaves the iron soft, highly resistant to corrosion and possessing other characteristics of copper.

WHITE LETTERS HARD TO READ BECAUSE OF EYE'S HABITS

White letters on a black background result in a delay to the reader of about ten per cent, psychologists of the University of Minnesota have learned as the result of lengthy research. It also was found that black type can be read at a fifteen per cent greater distance than the same size and form of white lettering. At a distance, words in white type appeared merely as a blur, it was reported. The explanation given is that the human eye and mind have been trained over long periods of time to associate dark spaces with objects and light areas with the intervening spaces.

AUTO RAILWAY HAS TURNTABLE TO SPEED OPERATIONS

Operations of a gasoline railway in New England are speeded up by a turntable set into the special track on which an automobile runs. The railway, connecting a New Hampshire town with the station at the base of Mt. Washington, is built across fields and through woods on a direct line between its terminals. It was established for the benefit of engineers of the Mt. Washington cog railway. The table can be operated easily by one man and turns the auto around quickly.

Turntable on Automobile Railway Enables Operators to Turn the "Train" Around Easily; One Man Can Do It Although Two Are Shown

Floodlights Lure Crowds to Father of Waters

Brilliantly Lighted Mississippi River Excursion Boats Which Continue to Attract Pleasure Seekers When Most Amusements Find Their Attractions Short-Lived

Excursion boats on the Mississippi are still crowded and report excellent business, although many other amusements have been complaining of poor attendance. The lure of the "Father of Waters," heightened by floodlights, is given credit for the phenomenon.

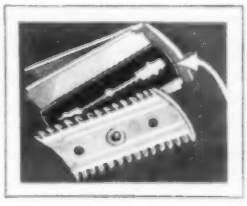
SANDSTORM CREATED AT WILL IN AUTOMOBILE FACTORY

In a Detroit automobile plant a curious-looking shed has been installed, inside of which sandstorms are created. Automobiles are driven into the shed and there are subjected to terrific sandblasts, simulating the actual conditions of a desert storm. The purpose of the test is to determine the efficiency of the car's apparatus for purifying the air before it enters the carburetor.

MEMORIAL PREPARED TO LAST TEN THOUSAND YEARS

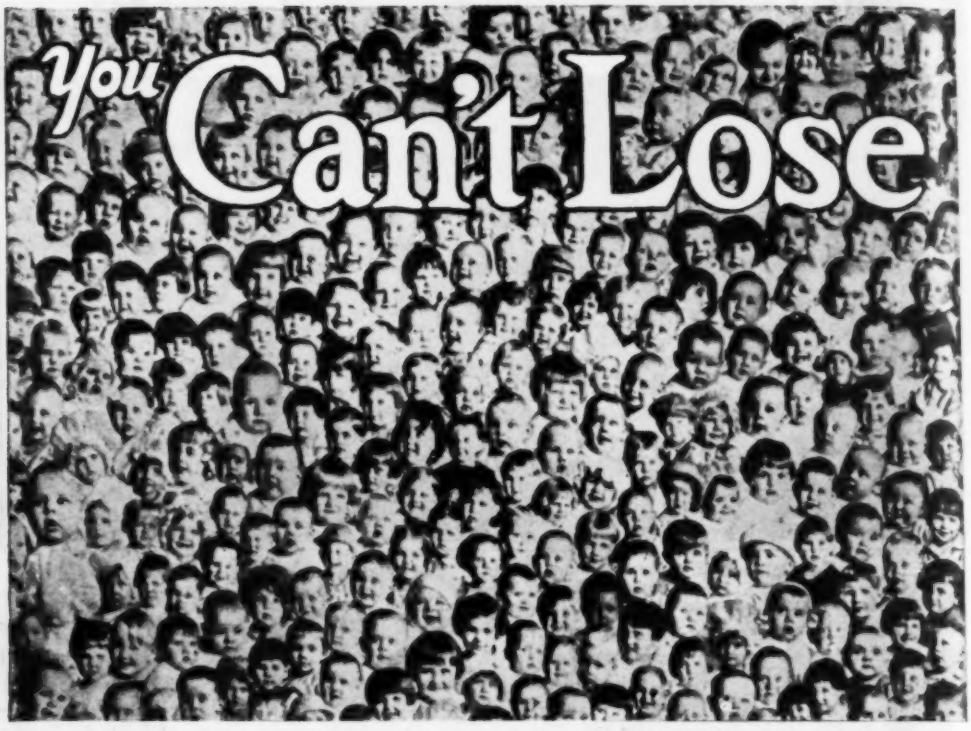
Names of the 1923 earthquake victims will be preserved 10,000 years in Japan. A superior quality of white Japanese paper, bearing the victims' names in Chinese ink, was selected by scientists. Then the paper was rolled and placed in containers made of the choicest Brazilian quartz crystals. Three bands of monel metal were inserted to insure uniformity of packing, two of the bands being covered with asbestos and the third with specially sterilized silk. Then the containers were closed with quartz lids fused on, and placed in water for the air to be evacuated. The vacuum was filled with argon gas, which has highly preservative qualities, so that interior pressure equaled atmospheric pressure. Then the containers were covered with asbestos braiding, taped with asbestos and placed in containers made of a compound of carbon and silicon, which is absolutely fireproof.

RAZOR BLADE SHOCK ABSORBER ELIMINATES VIBRATION



Safety razors now can be fitted with rubber composition cushions which act as shock absorbers for the blades. These cushions can be applied to any razor using a double-edged blade. The shock absorber slips over the prongs of the top of the razor after the blade has been placed in position, and the maker claims the resilient cushion keeps the blade from cracking and also stops vibration of the wafer blade.

You Can't Lose



Group of Babies in Kansas, the Most Healthful State; They'll Live to About Sixty

"YOU can tour Europe for $10.50 per day," the head of a tourist agency told prospective customers. "Simply decide how many days you wish to spend and multiply that number by $10.50. Make your own schedule; route yourself as you desire. Visit ten or a hundred cities and we will pay your every expense."

Experienced tour men claimed the plan would result in great loss; that travel in certain countries was much higher than in others; that no two trips figured the same per-diem price; that short stops and long jumps would be ruinous to the plan. At the end of the season, it was found that profits were within three-fourths of one per cent of the profit that had always been made on tours of this class and that it was in favor of the company—you just can't go wrong by relying upon the law of averages.

A business on Fifth avenue, New York, between Forty-second and Forty-fifth streets, will enjoy better trade on the west side of the thoroughfare if it caters to women, but if it caters to men, it will

Do You Know

THAT *it is four times as dangerous to take a bath as to mount a ladder?*

THAT *an air traveler is seventeen times as likely to die of heart disease as a crash?*

THAT *a girl baby born in Kansas will live eight years longer than a boy born in New York?*

THAT *Wednesday is the best day in the week to get out a crowd of business men?*

THAT *only one man in a thousand will ask for a hat size 6½?*

It's the Law of Averages!

if you Follow *this* LAW

Wheel of Fortune, Above, and Roulette Tables Thrown Wide Open in Reno, Nev., at Left; the House Can't Lose

do better on the east side.

A rainstorm in the morning decreases department-store business for the day, but rainfall in the afternoon after a bright morning results in an increase.

If you drive a car in Detroit, it will probably be twenty-five years before you injure a person, but in Boston you are lucky if you keep out of such an accident more than twelve years.

Summer or winter, twenty-four per cent more people walk on the shady side of the street than on the sunny side. One man out of every 124 passing a cigar store will enter and make a purchase.

Observation of a large number of cases of any kind is necessary to work out true averages. Individual peculiarities and tastes average up and are lost sight of in a big mass of people; the larger the crowd, the more definitely can it be predicted what an average person in it will do.

The more times an operation is repeated, the more likely to occur is any rare condition contingent upon that operation.

Practically all gambling games are founded on the law of averages. Success-

ful bookmakers at race tracks figure the chances of each horse to win and lay their odds to show a profit, no matter which horse comes in ahead. The odds against any single number winning any time the ball is twirled on a Monte Carlo roulette wheel are thirty-seven to one. A winner on a single number at roulette receives thirty-six times the amount of his stake. There being thirty-six numbers and a zero on the wheel, odds of thirty-seven to thirty-six favor the casino. That doesn't seem like a very large margin for the house, but it is plenty to keep them well ahead of the game every year.

Pimlico's Famous Horse Track, Above, and Wheels of Chance on a Gambling Ship, Outside the Three-Mile Limit, off California

The longer we have lived, the greater our additional age is likely to be. A boy ten years old may be expected to live until he is 59, but those who actually survive to age 20, will probably reach 66, and the average man of 60 lives to reach his seventy-fourth birthday.

An old automobile is much more likely to be stolen than a new one; the driver grows more careless as the machine falls in value. More automobile accidents occur on Sunday than on any other day of the week. More people are killed and injured by motors between seven and eight in the evening than during any other hour. Three times as many men as women are killed in automobile accidents, but in numbers injured the sexes run nearly even.

The probabilities are that no man can live long enough to be killed when a passenger on either a regular airplane line or on a railroad train. He might achieve it in the case of airplane travel, but he'd have to put in most of his time in the air and cover a distance of 3,500,000 miles.

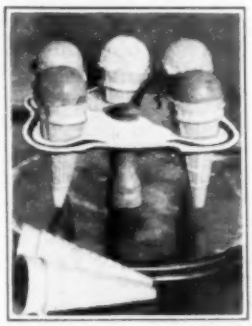
The law of averages is potent in taking

the gamble out of mercantile pursuits. A nation-wide chain of cigar stores selects locations by an actual count of the number of men passing the site. Knowing within a fraction of a cent what the average purchase will amount to, they can tell without likelihood of error how much the store will be worth to them.

As soon as the morning post comes in, a big western mail-order house can tell immediately whether to gear up for a big day's business or a light one. They simply weigh the mail. A large department store will do a greater business if located close to other stores of the same class, but the reverse is true of small stores.

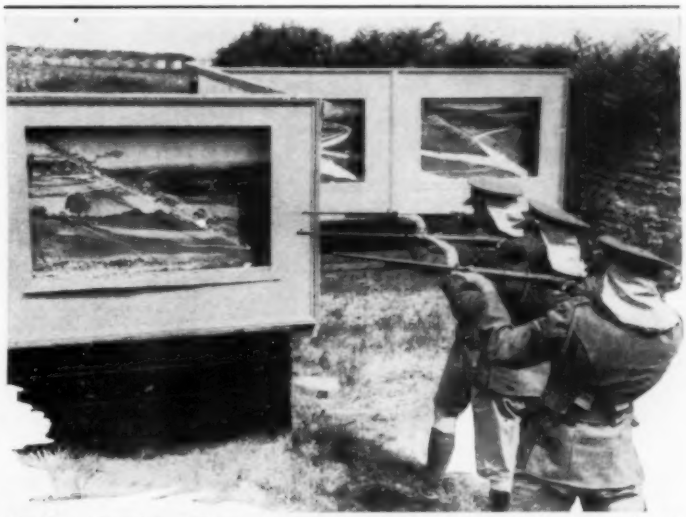
So close to average do the wishes of restaurant customers run, that many a chef is able to prepare exactly enough of each item on the menu.

DISPENSER FREES BOTH HANDS OF ICE-CREAM SALESMAN



Freeing both hands of the counterman, an ice-cream-cone tray has been devised that can be set down on a wooden holder while the salesman is filling other orders. The tray is made with a hole in the center and comes with a wooden peg either with portable base or one that can be easily attached to the top of the ice-cream cabinet. The hole fits snugly over the wooden peg of the holder, allowing the tray to be set down.

¶A committee of scientists has estimated the age of the earth as at least 2,000,000,000 years.



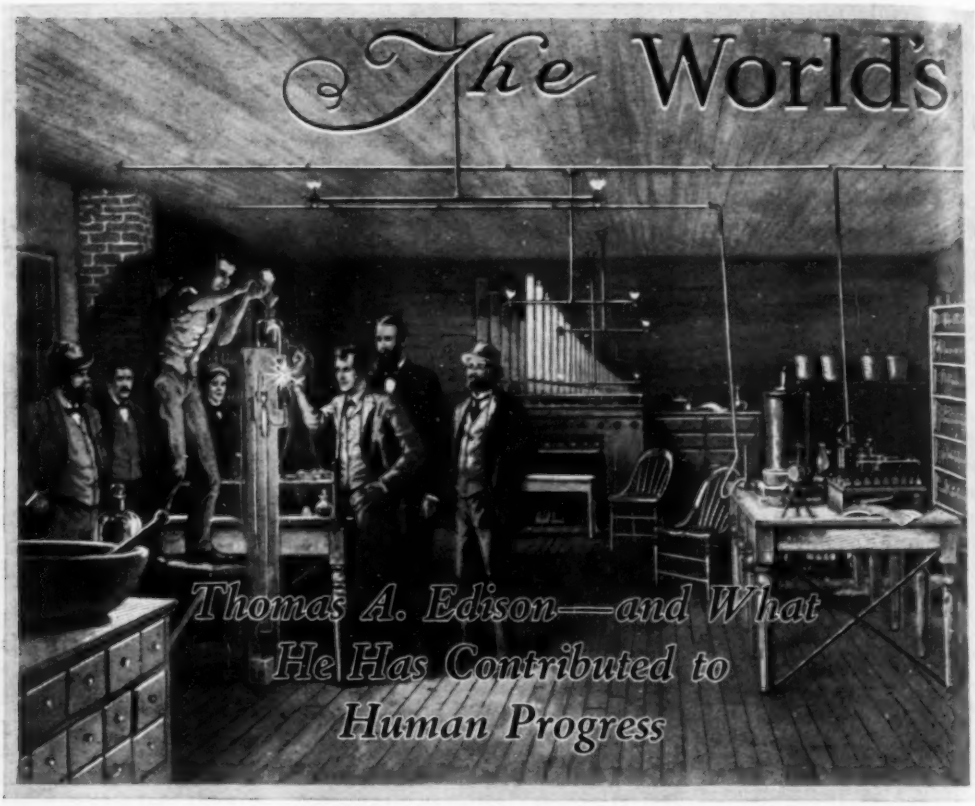
Outdoor Shooting Gallery with Frames Containing Scenic Backgrounds to Add Realism; Targets Move Along the Edges of Frames

COUNTRY SCENES ADD REALISM TO SHOOTING GALLERY

One English shooting gallery that is set up outdoors has added a touch of realism by installing painted country scenes in large frames as a background for tiny rabbits and other mechanical targets. The little animals move across a frame in front of the rural scenes, and the patrons blaze away at the targets in a natural setting.

OIL TAKES COAL FROM WASTE IN MINE EXPERIMENTS

Cleaning of coal by an oil process is yielding good results in several experimental plants in the eastern states. Sulphur content is reduced to one-half per cent, engineers say, and ash to about five per cent, under the process, which produces a fuel of high quality. Mine refuse is made to yield a large amount of coal under this treatment. The secret of the process lies in the fact that oil has a peculiar affinity for coal, but none for ash and other waste. The coal or mine refuse is first crushed and mixed with water, then pumped into an agitator and mixed with oil. Oil envelops each particle of coal, which sinks to the bottom of the container, while the water carries off the ash. As a general rule the oil amounts to about fifteen per cent of the finished fuel.



Birth of the Incandescent Lamp in 1879 at Edison's Laboratory in Menlo Park; Edison Is Standing beside the Apparatus, Which Burned Successfully for Forty Hours

WE may sit at home, bathed in colored lights and listen to gifted voices, to deathless music. Or we may project animated figures on a screen and hear their voices from a horn. Or a bell rings; answering, we may hear a voice from another continent.

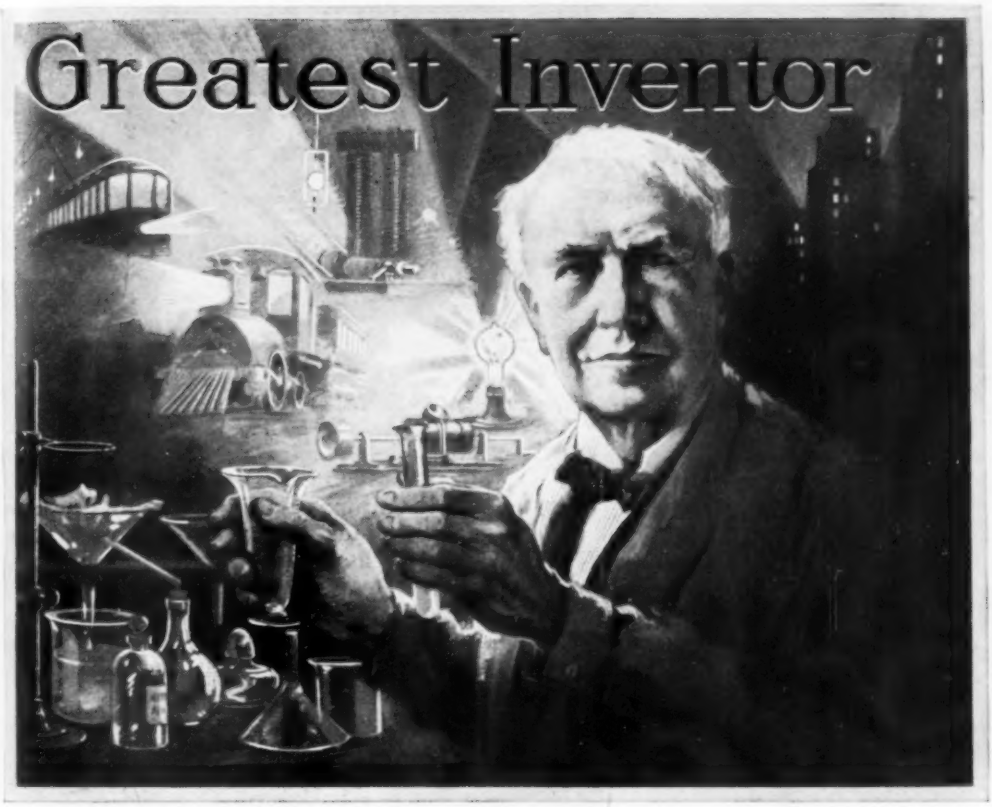
All these conveniences, within arm's reach in the modern home, bear the stamp of one man's brain—Thomas Alva Edison's. No king, no explorer, no militarist accelerated practical culture more than Edison. Indeed, he ranks with the five men whose lives have most influenced the career of the human race.

Aside from his name, his influence and example, he has created a fabulous fortune in gold and material out of no more material substance than the stuff that ideas are born of. Other men barter, buy and exchange, but they do not add to the world's wealth. Out of sheer common sense and persevering search, Edison presented mankind with an inheritance valued at more than $35,235,000,000. The prodigious total tends by contrast to make paupers of millionaires. The sum bears comparison with all the ransoms ever offered for kings, with all the bribes involved in political corruptions, with all the gold mined from the earth in the last century. Yet he has remained humble.

"Well," he says, "if worse comes to worse, I've got a good trade. I can always make $75 a month as an expert telegraph operator and I can live on that."

Edison was born at Milan, Ohio, on Feb. 11, 1847, the son of Samuel Edison, a mechanic. His close observation led him to ask many questions. He listened solemnly to the answers and then proceeded to investigate matters for himself. His boyhood escapades are still recounted by the citizens of Milan as part of the town's folklore. He was almost smothered once beneath a pile of wheat.

A playmate, aiming an ax at a skate strap, cut the tip off Thomas' finger. And



once the inquisitive youngster set fire to a barn, for which offense he received a public whipping.

When his family moved to Port Huron, Mich., Thomas attended a school for three months. That constituted all the formal education he ever received. Thenceforth he was on his own. Before the age of twelve, he had read Gibbon's "Decline and Fall of the Roman Empire" and Hume's "History of England."

Young Edison made the cellar his first laboratory. In order to keep others from tampering with his bottled chemicals, he pasted poison labels on them. All his pocket money went to buying more chemicals from the drug shops.

At length he convinced his parents that they ought to let him apply for the news concession on the Grand Trunk railway in order to increase his stock of chemicals. In one of the baggage-car compartments, Edison was allowed to set up a rolling laboratory, in which he kept jars, bottles, test tubes and every chemical compound he could afford to buy. In the same baggage car he set up a printing press and published "The Weekly Herald," sold at three cents a copy, and with a circulation of 400 per month.

The rolling laboratory and printing plant flourished until one day the car lurched and caused a stick of phosphorus to ignite and set fire to the car. The conductor rushed in, lost his temper and threw the young inventor off the train after cuffing his ears. Edison grew deaf from the unkind blow of this conductor.

From news vending Edison drifted into telegraphy. He worked in railroad and commercial telegraph offices, acquiring a facility in receiving and sending that is still talked about by veteran Morsemen. His dots and dashes came with such lightning rapidity that the best keymen would have to ask him to repeat. From Cincinnati, Louisville and Indianapolis he went to Boston and took over the high-speed press wire.

It was here that his mind began to bear

Copy of the Civil War Locomotive and Baggage Car That Was Edison's Early Laboratory, and, Below, the "Boy Inventor"

on practical problems. Armies of cockroaches sallied forth from hidden retreats no sooner than the "ops" had eaten lunch. How exterminate these pests? On the wall beside his table Edison fastened two strips of tinfoil; one strip was connected with the positive pole of a battery and the other strip with the negative pole. When a cockroach crossed the deadline, it electrocuted itself. He also invented a "rat paralyzer," which consisted of two insulated plates connected with a main battery. The rat would serve to complete the circuit and kill itself.

One day in the autumn of 1877 Edison handed John Kruesi, his modelmaker, a rough sketch. The inventor estimated that the machine would cost about $18. Kruesi followed specifications and produced an instrument consisting of a metal shaft mounted on two supports, resembling a horizontal screw. The shaft ran through a drum, on both sides of which was a little tube. Parchment was stretched over the ends of the tube, and the center of each diaphragm had a needle.

After wrapping a thin sheet of tinfoil around the drum, Edison proceeded to turn the handle, shouting at the same time, "Mary had a little lamb." Turning the screw backward, he withdrew one of the tubes and turned the screw forward on the other. Out came his voice, repeating the words he had uttered.

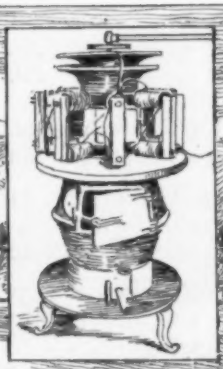
"Mein Gott im Himmel!" cried Kruesi.

"I was never so taken aback in all my life," said Edison. "I was always afraid of things that worked the first time."

The "Wizard of Menlo Park" soon had a fame that reverberated around the world. But nothing astonished people so much as his incandescent lamp.

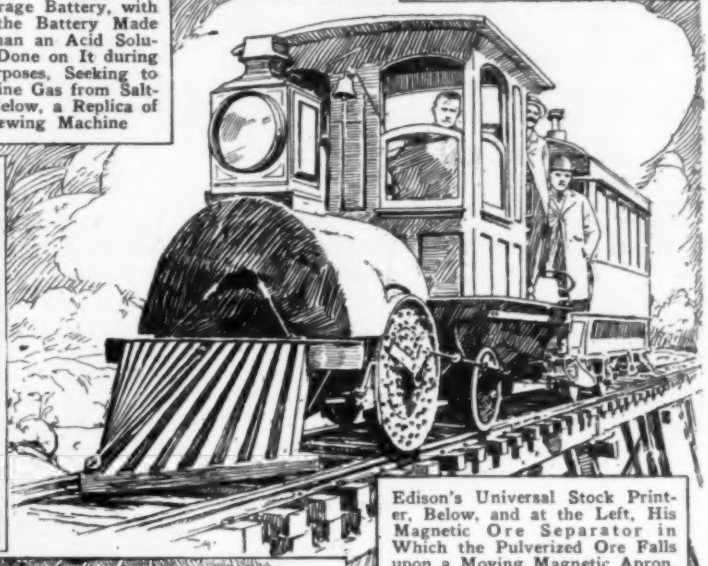
With a carbonized thread inside a bulb from which the air had been exhausted, he succeeded in attaching it to an electric current, thereby creating a new form of illumination. The first lamp remained lighted forty hours. Thirteen months of time and $40,000 were spent on that first bulb. But he needed a substitute for carbonized threads and forthwith he began to carbonize everything conceivable, even strands of hair plucked from a man's growing beard.

Two months after Edison and his assistants had seen that first incandescent light, the managing editor of the New

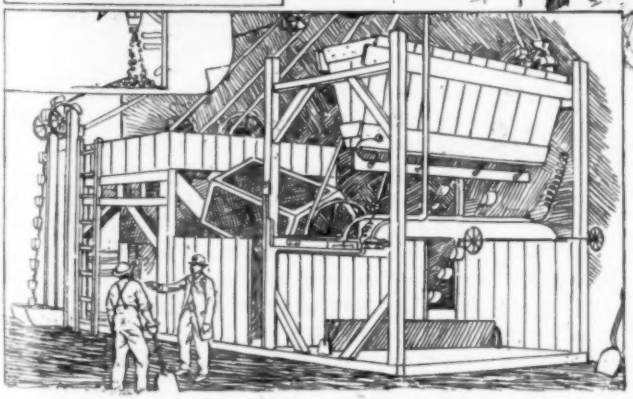


Thermal Electric Engine, Above, Designed to Turn Heat Directly into Electricity; the First Electric Railroad Locomotive, Designed and Built by Edison, and Which He Is Driving in the Sketch Below

An Early Electric Automobile, Above, Powered with an Edison Alkaline Storage Battery, with the Inventor in the Seat; the Battery Made Use of an Alkali, Rather Than an Acid Solution, and Much Work Was Done on It during the War for Submarine Purposes, Seeking to Obviate the Danger of Chlorine Gas from Salt-Water Contact with Acid; Below, a Replica of Edison's First Electric Sewing Machine



Edison's Universal Stock Printer, Below, and at the Left, His Magnetic Ore Separator in Which the Pulverized Ore Falls upon a Moving Magnetic Apron, the Iron Then Falling into Buckets While the Tailings Are Blown Off by an Exhaust Fan



Six of Edison's Inventions That Changed the Course of the World; the Thermal Electric Engine, the Model of Which Is Built around a Stove, Is the Only One He Never Developed

Edison's Greatest Achievements

1868 Made his first patented invention, an electrical vote recorder.

1872 Completed many inventions, including duplex, quadruplex, sextuplex and multiplex telegraph systems.

1875 Discovered previously unknown and unique electric phenomenon, which he called "Etheric Force," the foundation of radio.

1876 Invented the carbon telephone transmitter.

1877 Invented the phonograph.

1879 Invented incandescent electric lamp.

1879 Invented radical improvements in dynamos, making them suitable for light, heat and power.

1882 Invented and installed first life-sized electric railway.

1882 September 4. Commenced operation of first commercial central station in New York City for distribution of electric current for light, power and heat.

1883 Discovered a previously unknown phenomenon known as the "Edison effect." This covers the principle of the radio tube.

1881 Invented system of wireless telegraphy (by induction) to and from trains in motion.

1900 This period covers the work resulting in the invention of the Edison alkaline storage battery.

1905 Made many important inventions relating to the production of Portland cement.

1912 Introduced the Kinetophone or talking motion picture. He foreshadowed the production of this combined device in 1887.

1923 After the war he filed applications for many patents. Altogether he controls about 1,150 patents. Much of his time is devoted to investigating rubber growing.

York Herald stormed into the newsroom and accusingly laid a copy of that day's paper on the city editor's desk.

"How," demanded Connery, the managing editor, "did that stuff get into the paper, Mr. Orr? You've made a laughing stock of the Herald.

"Lights strung on wires, indeed! What will the owner say?"

"He'll probably say," Orr replied calmly, "that it is the biggest newspaper beat in a long time."

"But don't you know," continued Connery, "that it has been absolutely demonstrated that that kind of light is against the laws of nature?"

The Herald's article aroused such public interest that the railroad ran special trains to Menlo Park, where incredulous visitors saw the strange glow lamps strung on wires between gaunt leafless trees.

Later Edison worked out the whole system of incandescent electric lighting from a central station. He developed a new type of high-speed dynamo which greatly increased the quantity of his output. The first commercial electric-lighting system in the United States was opened in New York, and it proved highly successful.

At no time in his career has his famous laboratory been idle. The germs of inventions sprang from his mind in a never-ending stream and he kept scores of trained assistants busy with detail work. In rapid succession he invented the carbon transmitter for the telephone and the magnetic ore separator. In 1882, he built the first electric railroad line and a locomotive to run on it. Between 1900 and 1910 he entered the Portland cement industry. He invented the "long kiln," introduced the "poured" house, and perfected the alkaline storage battery.

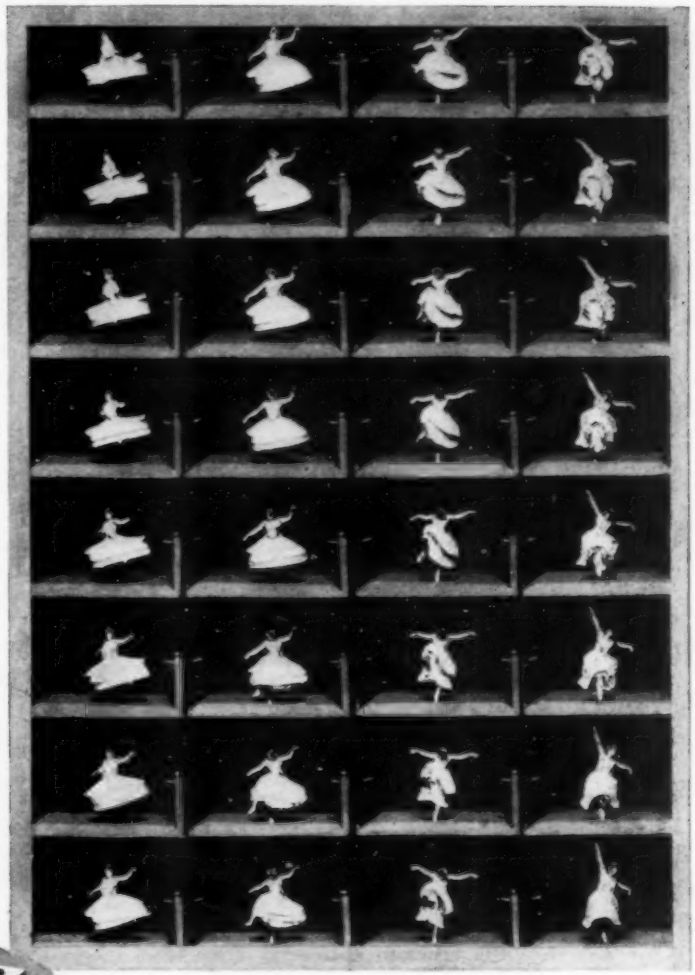
In 1912 he introduced the "kineto-

phone," a talking-movie system, of which he said: "The synchronization of sight and sound is an old idea of mine that has finally been realized. In one way or another it has been in mind for more than thirty years. Back in the late 70's when I invented the phonograph, it was stirring, and in 1887, when I was able to perfect the motion-picture camera, that idea of combining sight and sound persisted.

"The problem of actual synchronization was the least difficult of my tasks. The hardest job

was to make a phonographic recorder which would be sensitive to sound a considerable distance away, and which would not show within range of the lens. You get some idea of the difference when I make this comparison: If you estimate the volume of sound at a distance of one foot from the recorder at 100, you find that at a distance of two feet it diminishes to .25."

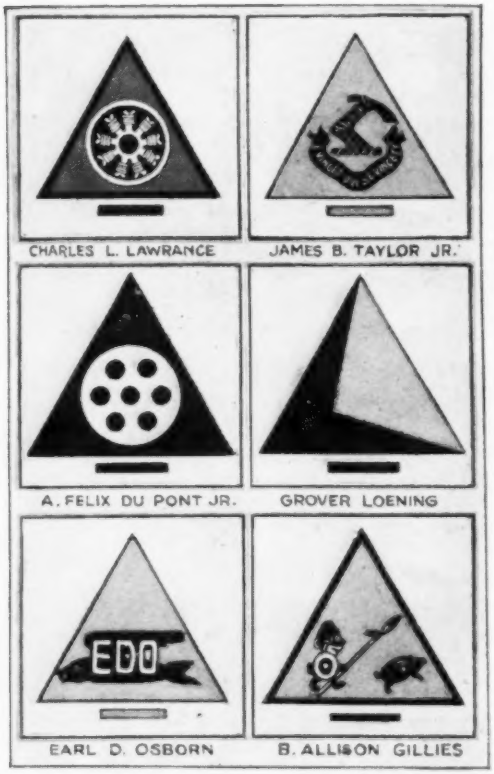
In his long life Edison has hardly known illness. He has a hardihood that survived excruciating labor. One of his



Kinetoscope Record of Carmencita's Dance, Made in 1887; at Left, the First Incandescent Lamp

chief assistants once begged the inventor to tell him how he acquired such uncanny powers of endurance. In a humorous vein, Edison replied that he ate Welsh rarebit for breakfast every morning. The assistant, following his employer's example, soon found that the diet made little difference to his own stamina.

Edison's constitution, which allowed him to work from eighteen to twenty hours a day over long periods, is a marvel to science. He has allowed himself few vacations and rarely indulges in outdoor sports. But observers noticed that in his daily habits he maintains a rigid discipline. He works with steadfast concentration and remarkable patience.



Examples of Insignia for Amateur Air Pilots, All in the Form of a Triangle and Bar

INSIGNIA FOR AMATEUR PILOTS LIKE THOSE FOR YACHTS

Amateur air pilots, affiliated with country clubs devoted to aviation, are being encouraged to select insignia to identify their planes somewhat after the manner of yachting registry. Instead of the conventional pennant of the yachtsman, however, the pilots select designs to decorate their planes. The same general outline, an equilateral triangle and bar, is employed for all, but inside the triangle any desired figure may be used, so long as it has not been registered previously.

VACUUM CLEANER FOR THE CAR ATTACHES TO EXHAUST

For the service station or car owner, a motorless vacuum cleaner has been developed that operates by creating a vacuum from the expulsion of gases. An aluminum attachment at the end of the cleaner hose is fastened to the exhaust pipe and the car engine is allowed to idle. As the gases pass through this device a suction is created at the inlet hole on the side where the hose is connected. The dust and dirt is collected by a nozzle, drawn through the hose and expelled into the air at the rear of the car.

CUSHION WITH TWO AIR TUBES IS MORE COMFORTABLE

Two air tubes are built into a patented cushion to give greater comfort, one tube running around the edge being inflated harder than the rest of the cushion as a support for the legs under the knees. The main or inner tube is blown up to a less degree, giving low-pressure air suspension which absorbs shocks with rebound and eliminates vibration.

BINOCULARS FIT LIKE GLASSES LEAVING BOTH HANDS FREE

Sports enthusiasts who are accustomed to using binoculars to watch the progress of distant races and other events now can obtain the instruments set in frames like those used for spectacles. The frames fit the head snugly to hold the binoculars in place, leaving both hands free, and have adjustable temples and nose pieces, the latter containing ventilating apertures, while each lens of the binoculars has an individual focus and a fine micrometer adjustment to insure good vision.

Small Binoculars Set in an Adjustable Frame so They Fit the Head Like Glasses

VOICES *across the* SEA

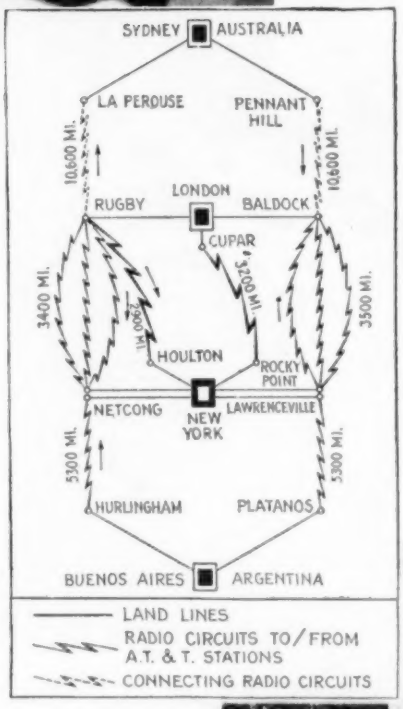
Speaking from Steamship 10,000 Miles to His Home Town, Above, and Below, Overseas Telephone Connections of American Telephone and Telegraph and Associated Companies

OUT in California, a salesman was so zealous for orders that he discussed business with a customer who spoke on the day following, and to whose question the salesman gave his reply on the day before—all of which does not seem to make sense, but is quite intelligible when you realize that the two were using the transatlantic telephone.

The conversation took place at 4:00 p. m., San Francisco time, which was 11:30 the following morning in Rotterdam, where the customer was located.

Only a little more than four years ago the transatlantic telephone service was opened between New York and London. Now the interconnection of telephones extends three-quarters of the way around the globe and from the Arctic circle to the fortieth parallel, south. By the simple process of taking down the telephone receiver, anyone in the United States, Cuba, virtually all of Canada, and in the principal cities of Mexico, can speak to subscribers in practically all parts of western Europe and Scandinavia. The northern part of Africa also can be reached by telephone, and in the southern hemisphere, Argentina, Chile and Uruguay, and eastern Australia and Java.

Schematic Drawing of Radio Channels Linking Bell Phones with Those of Europe, South America and Australia



While to the telephone user the process seems simple enough, in reality the combination of wire lines and radio circuits is complex and wonderful. The voice of a telephone subscriber anywhere in North America travels over land lines to long-distance headquarters in New York City. Here it is carried to a transoceanic switchboard, handled by trained men. From this switchboard, the voice travels through the control room to the radio station at Rocky Point, if the call is for Europe, thence to London. Or if the call is for South America, the voice is sent to Buenos Aires. The long-distance headquarters exchange is also connected with radio-receiving stations at two other points through which the replying voice is carried from London and Buenos Aires, respectively.

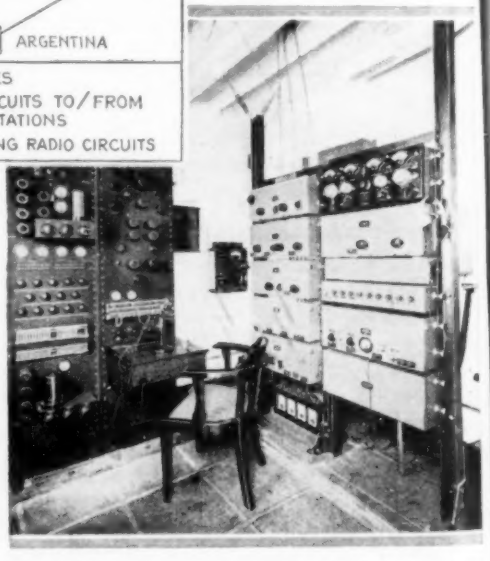
From the London trunk exchange, calls are conveyed by land wire and submarine cable to points in Europe, or to the stations establishing the radio circuits to Australia and Java. Buenos Aires is the switching point for Argentina, Uruguay and Chile.

While speed is often a factor in business between continents, the great usefulness of the transoceanic telephone lies not so much in the time element as in the way the telephone enables business men to talk man to man, to explain and to agree upon terms and conditions.

The fact that over the telephone details can be definitely settled made the transoceanic telephone particularly useful to brokers during times of heavy trading and rapid fluctuations in the stock market.

One of the most enthusiastic devotees of the transoceanic telephone is William C. Durant. It is said his longest conversation was from Berlin for an hour and fifteen minutes. His weekly bill for telephone calls sometimes runs into thousands of dollars.

An eastern corporation used the transoceanic telephone for settling a difficult question over machinery con-



U. S.-Mexico Line and "Empress of Britain," Receiver

tracted for with a firm in Glasgow. A change had to be made in the dimensions. A piece of machinery, already in fabrication, was scheduled for shipment from Glasgow November 15, and when it was discovered the change must be made, it was the middle of October. Delay would cost several thousand dollars a day.

"Why not try the telephone?" was a suggestion.

The company's engineers were standing ready, and within five minutes had explained exactly the situation, the heads of the firm in Scotland had confirmed their understanding, and the matter was settled.

Step by step the telephone is extending its scope throughout the world. Through control of the Constantinople telephone company by the international telephone and telegraph system, the way is opened for telephone communication between Europe and Asia, by means of cable under the Bosphorus. Ship-to-shore service of the American Telephone and Telegraph company links all telephones in North America with the steamships "Leviathan," "Majestic," "Olympic," "Homeric," "Empress of Britain" and "Belgenland." The overseas service is constantly being extended.

ANY BOTTLE MADE INTO SIPHON BY ATTACHMENT FOR CAP

Any metal-capped bottle containing a carbonated beverage can be converted into a siphon by a small attachment that fits the cap itself. The device consists of a metal cylinder with a threaded tip which is screwed through the metal cap. The bottle is then shaken vigorously to release the gas and when the container is tipped and a button at the top of the device pressed, the stream spouts from an opening at the side. There is a metal ball at the top of the tube which prevents fizzing when the bottle is upright and the button is pressed. When the bottle is tipped, however, the ball rolls away by gravity.

Cooking of "Hot Dogs" Is Easy with This Equipment Which Sends Electricity through the Meat

ELECTRICITY COOKS "HOT DOGS" LAID ON METAL CONTACTS

Electrical current, flowing from one contact point to another, is being used to cook "hot dogs." The dog is placed on two metal contact points, which are connected to the electric-light socket, the electricity is turned on, and the current thoroughly cooks the dog as it travels from one contact to the other.

MYSTERY CANAL ON SEA FLOOR MAY YIELD QUAKE SECRETS

Secrets of earthquakes will be sought by the United States navy in a survey of Bartlett "deep," a mysterious "canal" on the bottom of the Caribbean sea. The canal or trench is approximately 1,000 miles long and two miles deep. Careful charting of the trench, and of other parts of the Caribbean, says Dr. William Bowie of the coast and geodetic survey, will help reveal the cause of earthquakes in that region. Sonic depth finders will be used in charting the canal, soundings being taken by measuring the time required for an echo to travel from the surface to the bottom and back again.

Model of Plane That Looks Like an Army Tank; It Operates on a Mechanical Vacuum Principle

PLANE LIKE FLYING ARMY TANK TESTED IN MODEL FORM

Resembling an army tank in appearance, an airplane that the inventor says can rise or descend vertically and hover motionless in the air, was demonstrated recently in this country in model form. The flying tank is motivated by two propellers and operates on a mechanical vacuum principle. The maker of the ship says that he has already flown a model of his plane at his home in Newfoundland.

ODD TYPE OF STONE-AGE TOOLS FOUND IN SOUTH AFRICA

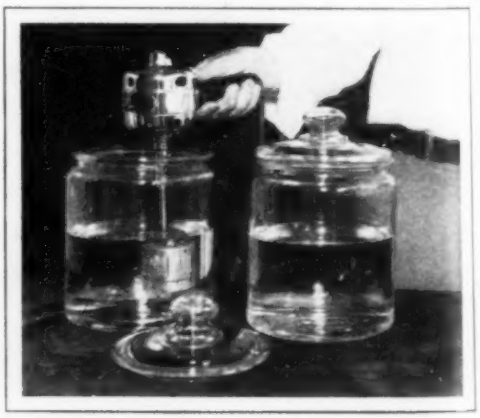
New types of stone-bladed tools that were used by prehistoric men and women thousands of years ago have been found in South Africa near the mouth of the Kogha river. The implements are of a kind hitherto unrecorded in scientific data and appear to represent a distinct stage in stone-age industry. Some of them are long, bladelike shapes, others are scrapers, gravers and points, but the most characteristic specimen is like a giant crescent and is shaped like a quarter of an orange with the flat surfaces forming the cutting edges. Previously a single specimen of the crescent-shaped tool had been found, but it had not been considered as associated with any type of stone-age culture.

OYSTERS GROWN FROM SEED REAPED EACH YEAR

Planting seed oysters from Japan about the first of each year, a company operating on Puget sound has adopted the sow-and-reap method of oyster culture so common to agriculture. Fifty million oysters now are growing in the company's beds and each fall's crop will be replaced by planting the following spring. Care will be taken not to allow the oysters to attain their full growth, but they will be gathered when at the right size.

"SODA-MIXER" WATCH CLEANER OPERATED BY MOTOR

Watches can now be thoroughly cleaned in less than three minutes with the aid of a tiny washing machine that somewhat resembles a soda-fountain mixer both in appearance and operation. The timepiece is taken apart and the dissembled parts are placed in two wire-lined containers which telescope to form a cylinder. After the top is placed on the cylinder, the assembled cleaner with the watch parts inside is attached to the spindle of a small electric motor. The cleaning compartment has hooded openings through which a cleaning solution is forced when the cylinder is dipped in it and started spinning by the motor. The solution is picked up at the top and bottom of the cylinder and diffused to all parts, then forced out through side vents. The actual cleaning operation takes only a minute and a half.



Mechanical Watch Cleaner Like Soda-Fountain Mixer; Watch Parts Are in Cylinder in Jar

MODERN ARCHER OUTDOES WILLIAM TELL'S FEAT

William Tell's famous trick of shooting an arrow into an apple on top of his son's head wasn't so difficult. A modern archer, Chester Seay of Los Angeles, does that one at fifty feet, with the arrow piercing an apple balanced on his girl assistant's head. Another of Seay's trick shots is the bursting of a toy balloon held between his assistant's teeth at a distance of fifty yards. In a demonstration of this trick, it took four shots to burst the balloon, but not a freckle on the nose of his assistant, Carroll De Witt, was disturbed. At fifty feet, Seay can knock the ashes off a cigaret with an arrow, split an arrow on a knife blade and other fancy shots. Seay, who is captain of the Los Angeles Archery club, is regarded as one of the foremost archers in the world and is outstanding for his trick shots.

Right Through the Apple Goes an Arrow from Modern Archer's Bow, at Right; Above, Bursting Toy Balloon

MOTION PICTURES TEST VISION BY REVEALING EYESTRAIN

Motion pictures provide a good test of vision, as many people have discovered after suffering from eyestrain resulting from an evening at the movie theater. More effort is demanded from the eyes at the motion-picture show, as a person who needs glasses for distance and who goes without them because he suffers no discomfort, will find the trouble asserting itself uncomfortably upon frequent visits to the movies. This is particularly characteristic of middle-aged people who wear glasses only for reading. Screens and seats in theaters rarely are handled in any manner other than to allow a person occupying a seat at least 20 feet in front of the screen to sit through a program without undue visual exertion. The motion-picture shows have done much to reduce eyestrain by proper elevation and angling of the screen, partial lighting of the theater to eliminate harmful effects of the sharp contrast between the darkened surroundings and a bright screen, and by attempting to arrange seats correctly.

¶To lessen the hazard of forest fires, Michigan conservation officials are urging that all automobiles be equipped with ash trays.

FLYERS of the

How Germany Is Training Pilots of Giant Seaplanes Able to Cross the Atlantic

"SAFETY for the passengers" is the motto of a school for German seaplane pilots on the Baltic. Daily and nightly lessons and flights aim to bring air travel to the acme of perfection and safety. All kinds of nautical maneuvers with flying boats and seaplanes are practiced, such as towing the planes by tugs or other craft and the transfer of passengers to ships.

A seaworthy patrol boat, with steam up, lies always ready at the landing pier. Pilot, radioman and mechanics make up its crew. Wireless links the boat, planes and land station together. A radio direction finder locates seaplanes in distress or forced to alight on the

When a Flying Boat Encounters Trouble in the Air, It Lands at Sea, Signals Its Position, and in This Case, Is Towed In by a Fishing Smack

the SEA

water by motor trouble.

You board the patrol boat and, in leaving, pass a floating dock, large enough to accommodate the giant "DO-X," and the forty-five foot runway of a catapult which shoots planes into the sky by air pressure.

High above rumbles the agile "New York," a new craft, which in a few days will accompany the express liner "Bremen" on its trans-atlantic voyage and save twenty-four to twenty-eight hours by bringing mail from ship to land. With the roar of its 560-hp. motor mingle the lesser voices from the engines of the "Dornier Wal" and the

A Chain of Free Lights Anchored to a Buoy Shows Wind Direction and Marks the Channel; Below, Covered Cockpit for Blind Flying

Junkers "W-33" in a symphony of rhythm and power. They fly ahead of you over the sea, where practice is to begin. The command is taken by the leader of the seaplane division himself.

"Man overboard!"—a life ring flies into the water—he who represents the accident victim must be pulled in—the patrol boat lies to, carefully, lest the ring be caught in the backwash. The life preserver must be lifted by hand, according to rule, not by boathooks.

A collapsible rubber boat—every seaplane carries one of them—is let down upon the water. Very light and taking little space, it is the logical life-saver of these craft. In a few seconds a compressed-air bottle, mounted on it, inflates the hollow rim. Two men with paddles board it and row toward the "Dornier Wal" to be taken aboard.

Some distance away, swimming on the water, the "W-33" comes into view. You

Passengers Are Taken from Plane to Patrol Boat in Collapsible Rubber Boats; at Left, Fitting a Sea Anchor

proceed toward the plane which has radioed motor trouble. On its pontoons stand two of the crew, radioman and mechanic. The pilot turns the plane so that current and wind will not drive it and the sea anchor apart.

The helmsman maneuvers to keep the stern before the nose of the plane. A line, thrown from your boat and caught by the men on the pontoons, is tied to a hook on the plane's struts—and so the craft is taken in tow.

The successful maneuver portrays the saving of passengers and crew in a real accident. Not only steamers and motorboats are able to tow a plane, but any fishing cutter, which happened to come on the scene, could do it. One of the plane's crew would simply board the cutter, by means of the rubber boat, and direct the work from there.

Far out on the sea, the patrol ship encounters the "Dornier Wal." Slender and tapering like a fish, it floats on the rocking waves. Its front motor is turned off. The rescue crew stands in the stern ready to throw the towline to the "Wal." The passengers now can be brought safely aboard, and the plane towed to port.

In the night, the same routine is repeated. The patrol boat runs out, its bright searchlight beam scanning the sea. The seaplanes lie in darkness moored to buoys. One of them, the "Wal," is at sea, and it is the object to locate it. Al-

ready a radio message and the searchlight have indicated the direction, and the giant bird soon is seen swimming on the water. Lights define its contour. Between the struts stand the radioman and mechanic signaling. The towline already has reached its goal. The "Wal" is towed back to port.

The whole maneuver takes only a short time. Then the practice is resumed—again the light beam searches sky and sea, until, between scurrying clouds, is discovered a Junkers "W-33" on night practice for preparation on an air-mail line.

Through fog and clouds, this mail plane finds its way by blind flying. All year blind-flying practice goes on for the benefit of student pilots.

THIRTY-POUND BOAT OF METAL CARRIES QUARTER TON

Capable of carrying 500 pounds and a twin-cylinder engine, a boat built of duralumin has been constructed that weighs only thirty pounds. In addition to its extreme lightness, the craft is constructed with two compartments hinged together, so that it can be transported knocked down with the forward half folded over the aft section. It is claimed by the builder that the boat is thirteen per cent stronger than a steel craft of the same size.

Thirty-Pound Boat That Carries a Quarter Ton and Can Be Transported with Forward Half Folded over the Aft Section

Glass Reflectors on a Belt Protect Street-Car Conductors and Track Workers from Autos at Night

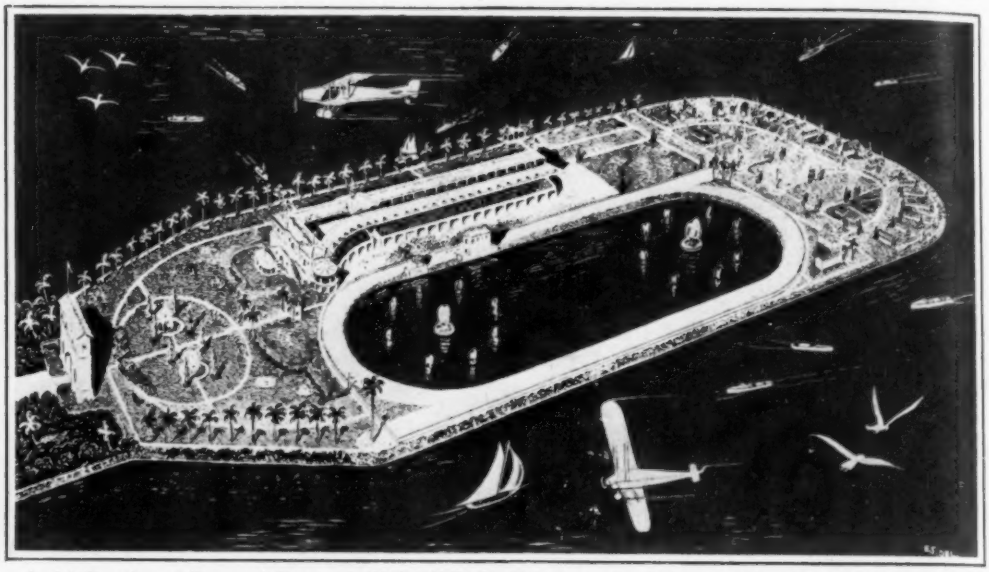
TRACK WORKERS ARE GUARDED BY REFLECTORS

Glass reflectors set into a safety belt worn over the shoulders and around the waist, guard street-car conductors and track workers from motorists at night. Fourteen pieces of glass in each belt reflect automobile lights, enabling drivers to see the wearer.

SHORTAGE OF WILD LIFE BLAMED ON SUNSPOTS

Ultraviolet radiation from the sun is the reason for the ten-year cycle of shortage among birds and mammals, according to the theory of Prof. William Rowan, of the University of Alberta, pronounced at a recent meeting of the Canadian biological conference. In connection with the ruffled grouse it was found that more than thirty parasites and diseases threaten their existence at all times, and that their decennial decrease is largely caused by lack of ultraviolet radiation, thus allowing the disease more complete sway. It was argued that the changes in ultraviolet intensities are caused by sunspots.

Racetrack in Bay to Be Built on an Island



Aerial Drawing of Proposed Racetrack Which Will Be Built around a Lake on a Man-Made Island in Florida; Special Provision Is Made for Airplanes and Boats to Land Passengers

Thoroughbred horses will race around a thirty-two-acre lake on a man-made island constructed as a site for a racing plant at Miami Beach, Fla. The island will be 4,600 feet long and 2,000 feet wide, sufficiently large to accommodate track, club buildings, stables and dormitories, and a park. The lake will be in the center of the track. Speedboats and airplanes will be used to reach the track, with docks and landing fields provided.

POCKET STOVE WARMS HANDS WITHOUT FLAME OR ODOR

So small that it fits easily in a coat pocket or handbag, a gasoline stove no larger than an ordinary flashlight supplies a constant source of heat that is easily controlled. It consists of a cylinder with a ventilated top which contains the mantle or heating element. Inside is a tube containing a wick which is saturated with gasoline. The stove is started by merely bringing the mantle in contact with a lighted match for a few seconds and screwing on the cover. The heated mantle draws the gasoline from the wick as fuel, and the stove burns without flame or odor for several hours. It is extinguished by reversing the tube containing the wick, thus cutting off the air, and the heat can be controlled by wrapping the warmer in a cloth, thus reducing the amount of air penetrating through the perforated cover. It can be used on cold days to keep the hands warm, and is likewise employed in bed as a foot or chest warmer.

CITY NOISES HINDER THE BLIND IN LEARNING TO WALK

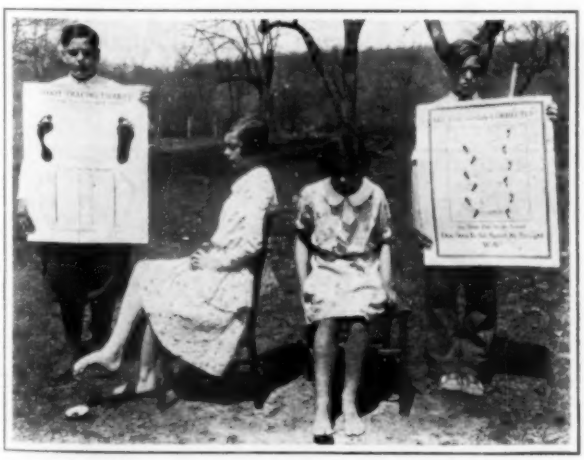
City din often prevents blind persons from walking straight, and children born blind many times must be removed from the city before they can learn to walk, it has been discovered as the result of a survey in New York. The noise of the city drowns the sound of the blind man's footsteps by which he ordinarily is guided, it was said. The average blind person also listens for the footfalls of others to avoid collisions, which consequently are more numerous in the city.

GRASSHOPPER TRAPS ON AUTOS HELP HARVEST CHICKEN FEED

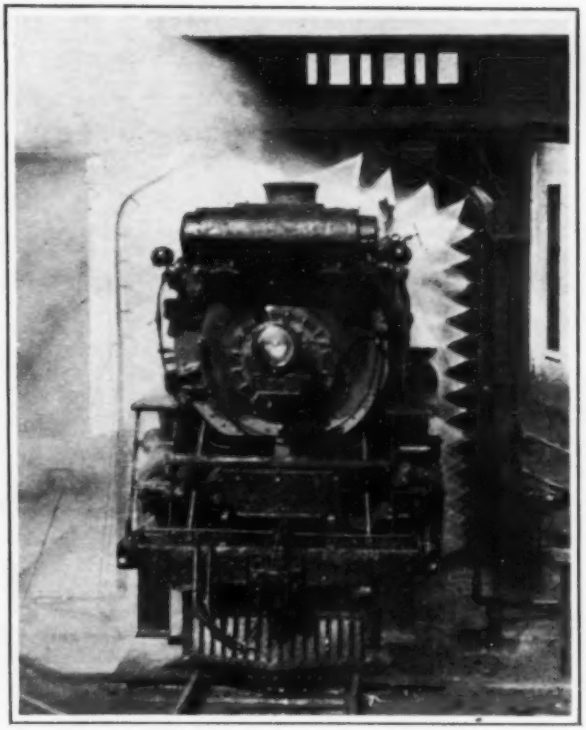
Farmers in certain grasshopper-infested regions have devised a means of turning the destructive pests into chicken feed. Troughs are placed in front of their automobiles as they are driven through the grain fields. The troughs are partly full of water, into which the insects fall. Later they are poured into sacks to dry, and this winter will be fed to the chickens. One farmer gathered thirty bushels of grasshoppers to the acre by this method.

EDUCATING OF TOES LIKE FINGERS SAVES ONE STEP IN SIX

Children in the boys' and girls' agricultural clubs all over America are being taught how to use their toes through the extension service of the department of agriculture. To prevent fallen arches, it is of especial importance to develop the muscles in the big toes, it has been found. The children also are taught to walk straight, with the sides of the big toes in a straight-ahead line, as the Indian walks. Attention is called to the fact that straight walking saves one step in six.



Boys and Girls Learning to Pick Up Objects with Their Toes to Prevent Fallen Arches and Other Defects



Courtesy N. Y., N. H. & H. R. R.
Locomotive Receiving a Shower Bath after a Run; This Washer Cleans an Engine in Less Than a Minute

ENGINES GIVEN SHOWER BATHS BY AUTOMATIC WASHER

Locomotives must be cleaned thoroughly after every run but instead of turning a hose on them, one eastern railroad has installed an automatic shower bath for its engines. The washer consists of a series of spray nozzles arranged at the side and over the track so that an engine passing through the shower will be thoroughly cleaned. A hot cleaning solution is sprayed on the locomotive at high pressure to remove grease and grime, the nozzles swinging into position as the engine approaches the washer. Less than a minute is required to run an engine through the shower. In addition to improving the appearance of the locomotives, the clean condition will add to safety, as the washer enables inspectors to note defects more easily.

Long-Distance Aerial Camera Mounted in an Auto-Gyro Which Will "Cover" News Events from the Air for a Detroit Newspaper

HOVER PLANE AND AIR CAMERA JOIN NEWSPAPER STAFF

With a huge aerial camera mounted in the front cockpit, a three-place auto-gyro has been added to the facilities of the staff of the Detroit News. The plane was selected because of its ability to land and take off in small and restricted areas, to fly at slow speed once in the air, as is oftentimes necessary in news photography, and because it can "hover" over selected spots for short periods. The plane will descend vertically at parachute speed.

DEADLY GAS TO SOUND OWN WARNING

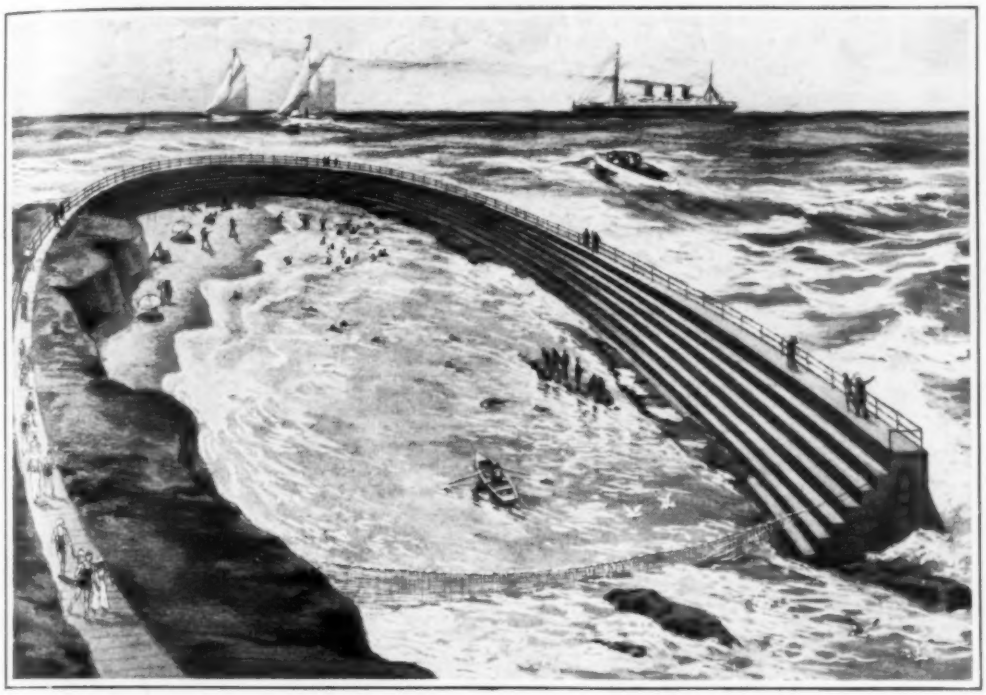
Danger of carbon monoxide poisoning from the first heating plant ever installed on an airship will be eliminated on the "Akron." The escaping gas will flash a light and ring a buzzer when the concentration reaches as much as one-hundredth of one per cent. Heat for making the airship comfortable will be furnished by the engines, from which carbon monoxide is expelled through the heating system. The warning devices will be set off by the gas in control and engine rooms, the heating system will be cut off, and the air which otherwise circulates through it will be discharged outside the ship. Thus the trouble can be investigated and the leak found without danger to those aboard.

"TOUR" ON CANVAS SHOWS DRIVER'S MISTAKES

Mistakes in driving are revealed by a "trip" on a painted landscape while the driver is seated in an auto body in a laboratory. An Iowa State College professor, attempting to find why some drivers get "tangled up" in traffic while others go through easily and safely, designed the equipment to test reactions to all driving conditions. The driver, seated in the laboratory auto equipped with standard controls, looks at a miniature landscape painted on canvas which revolves toward the driver on two rollers. On the road is a toy car which is guided by the steering apparatus of the car in which the driver is seated. A meter, attached to the test car, records the mistakes of the driver while on his trip.

"Automatic Landscape" That Reveals Mistakes in Driving to Students in College Laboratory

Safe Swimming Pool Is Built into the Ocean



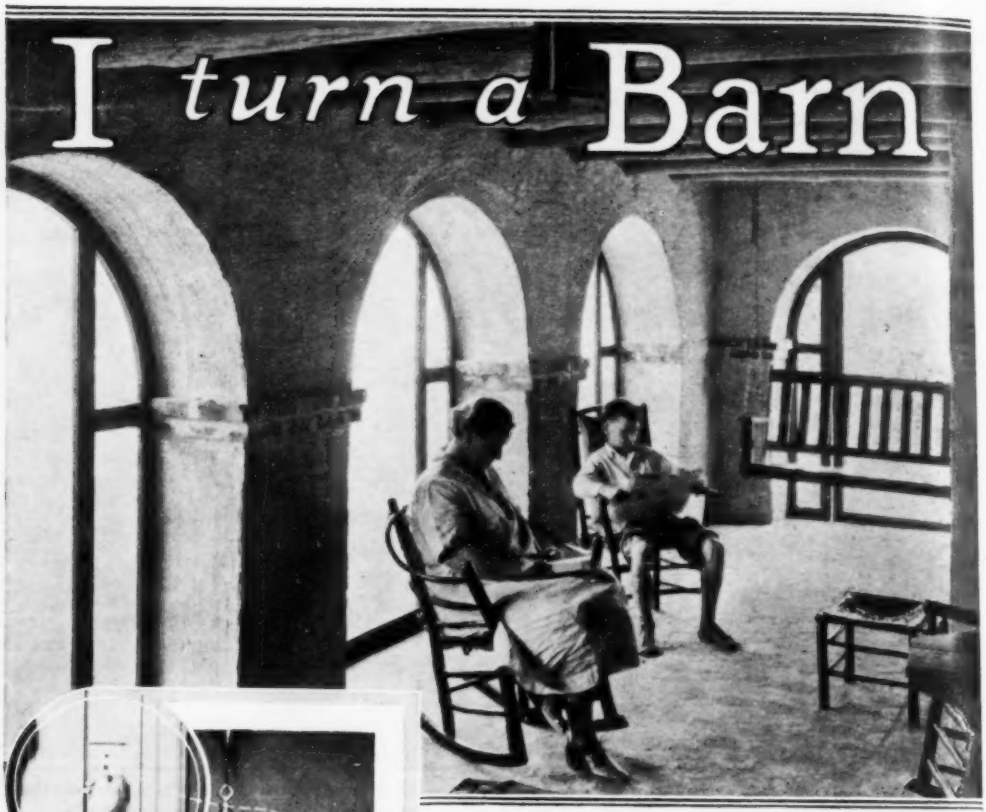
Breakwater Built into the Ocean Furnishes a Beach, Pool, Diving Platforms from the Rocks, Grandstand for the Spectators and a Promenade

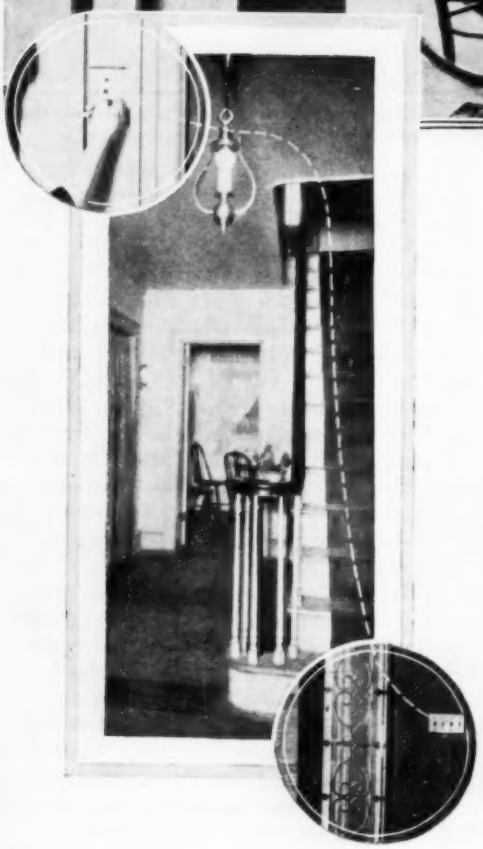
Building a breakwater on dangerous rocks, engineers at LaJolla, Calif., have constructed a safe swimming cove in the ocean. The formerly hazardous rocks now provide excellent diving platforms. The inner side of the breakwater is stepped like the downstream side of a single-arc dam, so that it forms a grandstand for the spectators. A floating line prevents swimmers being swept out to sea, and a small beach provides a safe place for the youngsters.

EROSION RUINED MAYAN EMPIRE EVIDENCE INDICATES

Because the face of the land in which they lived began to change insidiously, the Mayas of prehistoric America temporarily lost their grip on civilization, and their first empire fell. This is the view of Dr. C. Wythe Cooke of the U. S. geological survey, who has returned from a study of the region. He found the hills today to be forested with big trees and a little underbrush while the lowlands are a tangled mass of twisted trees covered with vines and flooded in the rainy season. This indicates that at one time the plains were lakes the year round, affording plenty of water and good transportation, both of which are inadequate today. Doctor Cooke suggests that possibly the transition from lake to lowland took place during the time of the Mayan empire, the heavy black soil being washed away until the land was abandoned and reverted to the jungle. The erosion of the soil would have been accelerated by the Mayas themselves, who cut down forests to grow corn for their large population. If the geography of the region in Mayan days had been the same as now, all provisions and merchandise must have been transported on the backs of men and human burden bearers would have had a hard time traveling over the low plains, but if the lowlands were lakes, travel would have been easy. The calamitous change of the lakes into plains also may have brought disease to the Mayas, thus hastening the fall of their civilization.

I turn a Barn





Porch of the House at Left; Hall and Stair Lights Should Be Controlled from Two Points

Architect Tells How to Remodel and Judge the Value of a House

By WILLIAM D. BRINCKLOE

THIS is the story of how I turned an old frame barn into a home for myself.

The building was the usual two-story frame type. The hayloft was floored with wide boards in fair condition.

Everything, in fact, was in good condition. Here is illustrated the first rule of remodeling, which is:

Never try to remodel something that is not worth remodeling; be sure the old building is in good shape with sound timbers. Don't try to use the old material over.

Except for one section of wall, I did

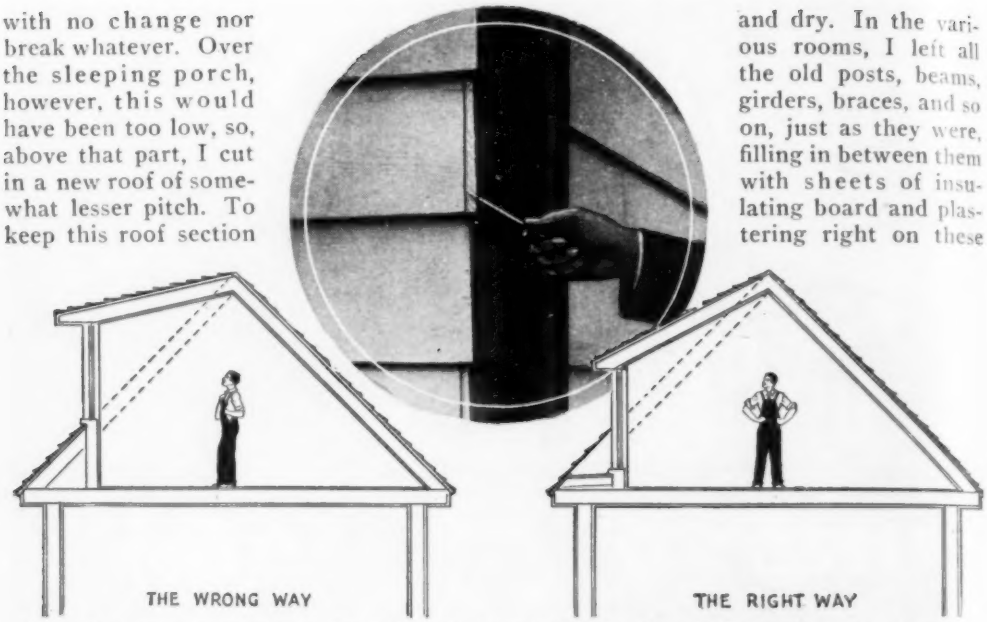
The Finished House, Above, and the Barn from Which It Was Constructed, and Almost All of Which Was Used, Below

not tear out a single bit of the old exterior shell. The barn was a little too wide for a well-proportioned living room, so I ran up a new partition, leaving the space beyond this for a vestibule, and the remainder was thrown into the porch. At one end I worked in a dining room and stairway with a new kitchen built on the outside. A porch was constructed along the left side, with a clothes closet to continue it. Illustrating rule three: If rooms are too small, tear down some partitions and throw two or more rooms together, and then, if necessary, build on new rooms.

Upstairs I did no tearing out whatever; there was ample space in the old haymow for three bedrooms and stairway. The bathroom was built over the new kitchen and the sleeping porch, and two closets were worked in over the downstairs porch and clothes closet.

I built my new roof by carrying the original roof line down over the closet

with no change nor break whatever. Over the sleeping porch, however, this would have been too low, so, above that part, I cut in a new roof of somewhat lesser pitch. To keep this roof section



Example of Poor Construction to Save Labor; the Joints Should Be Mitered, Above; the Right and Wrong Way to Raise the Roof to Add a Room in the Attic

from being entirely too flat, I built the floor of the sleeping porch about two feet lower than the old second floor, with three steps down to it. No one ever would suspect from the roof lines that this section was added years after the original roof was built, thus illustrating rule four: The new work should harmonize in design, in proportion and in materials with the old. If a stranger passes by and says "that's a remodeled house," the job is a failure.

I covered the old barn, as well as the new frame additions, with cement stucco on metal lath. As a general rule, it's a good plan to stucco any remodeled building; it makes new and old work look alike, gives a solid, substantial effect, and renders the old portions weather-tight and warm.

Inside the house, I covered the first-story floor with three inches of concrete, poured right down on the earth. Over this, in some of the rooms, I laid floor tile; in others, composition flooring; in still others, I merely finished off the concrete with a smooth top dressing. My friends prophesied all sorts of disaster; The floors would be cold, damp, and altogether undesirable. But their croakings came to nothing; the floors were warm and dry. In the various rooms, I left all the old posts, beams, girders, braces, and so on, just as they were, filling in between them with sheets of insulating board and plastering right on these sheets. Many owners of one-story cottages would like to add a bedroom and bath in the attic by taking off the roof and rebuilding it higher. There is an easier way to achieve the desired effect.

Saw through the rafters near the eaves, and lift them up as if they were hinged at the ridge pole—the whole thing, shingles and all. Then, build in a low frame wall along the front, with windows, preferably of the Dutch dormer type, tucked in it. The principal thing to avoid in this sort of remodeling, is to swing the roof up too far. If this is done, so the windows will be on top of the old roof section, the roof will look top-heavy, and will not have sufficient pitch to keep the rain from running back under the shingles. Instead, set the windows much lower and cut away the old roof in front of them.

A great many prefer to buy a house rather than build or remodel one. There are five elements of value you should consider in your choice of a house: location, appearance, floor plan, structural features and mechanical installations. The most important of these, and the most difficult for the persons not trained in carpentry, is that of structural design.

Before entering a house, I always devote plenty of time to examination of the

materials and workmanship on the outside.

Start with the foundation walls and keep a careful lookout for vertical cracks which may indicate a settlement of the structure. If the concrete is uneven, has holes in it, and has corners broken, not enough cement has been used or the concrete has been carelessly placed in the forms. The sills of all windows should drain outward. Areaways under windows should have a drainage outlet for rain water and snow.

Additions Often Are "Stuck" on, Above; If the Gable End Exactly Matches the Old, the Effect Is Pleasing, Below

Measure through a cellar window to check the wall thickness. Eight inches should be considered the minimum for concrete, and twelve inches for brick, hollow tile, or concrete blocks. Examine the joint between the top of the wall and the sill to see that there are no air spaces.

If the side walls are stuccoed, look for any sign of cracking or of mortar spalling off. Vertical cracks in masonry due to settling of the foundation are most likely to develop around window and door openings.

Exposed brickwork should be built of hard, well-burned brick which in themselves are durable. The mortar joints should be filled, not simply closed up at the outer edge of the brick.

The only sure way to tell how good the draft is in a chimney, is to build a fire and see how it burns.

The basement floor should be dry; look for water stains along the angles between floor and walls. All holes where pipes come through the foundation wall should be cemented.

Overhead you will see a row of floor beams. These should be spaced evenly, usually every sixteen inches, and be bridged about every eight feet of their length with crossbraces cut to fit snugly. Look carefully at any joists which have been cut to permit piping.

Evidence of the use of unseasoned lumber in the construction of a house will be plaster cracks, gaps between the bottom of the baseboard and the finished floor, uneven floors, creaking stairs, sticking doors and the opening of mitered joints.

Go upstairs and, as you walk over the floor, notice if it squeaks, or if it seems to deflect or spring under your weight. Neither of these things should happen.

In a new house you should never be able to detect the outline of the wood lath through the plaster.

Inspect as much of the roof surface as possible. No matter what type of covering is used, be sure that flashing of rustproof material is fitted around the chimney, at vent pipes and skylights, and along the "valleys"—the channels formed at the intersection.

Modernistic View of Bankers Trust Building in New York, Obtained by Aiming Camera at It from Top of Another Skyscraper

LOOKING DOWN UPON TOWER GIVES MODERNISTIC VIEW

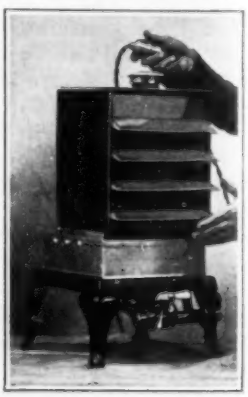
From the top of a near-by skyscraper, a photographer recently made an unusual picture of the Bankers Trust building in New York. The pyramidlike roof of the structure towering above Wall street presents a modernistic effect when viewed from above, the impression being enhanced by the perspective of straight lines afforded by other buildings.

PILOT FLIES IN THUNDER CLOUD AND FINDS TERRIFIC WIND

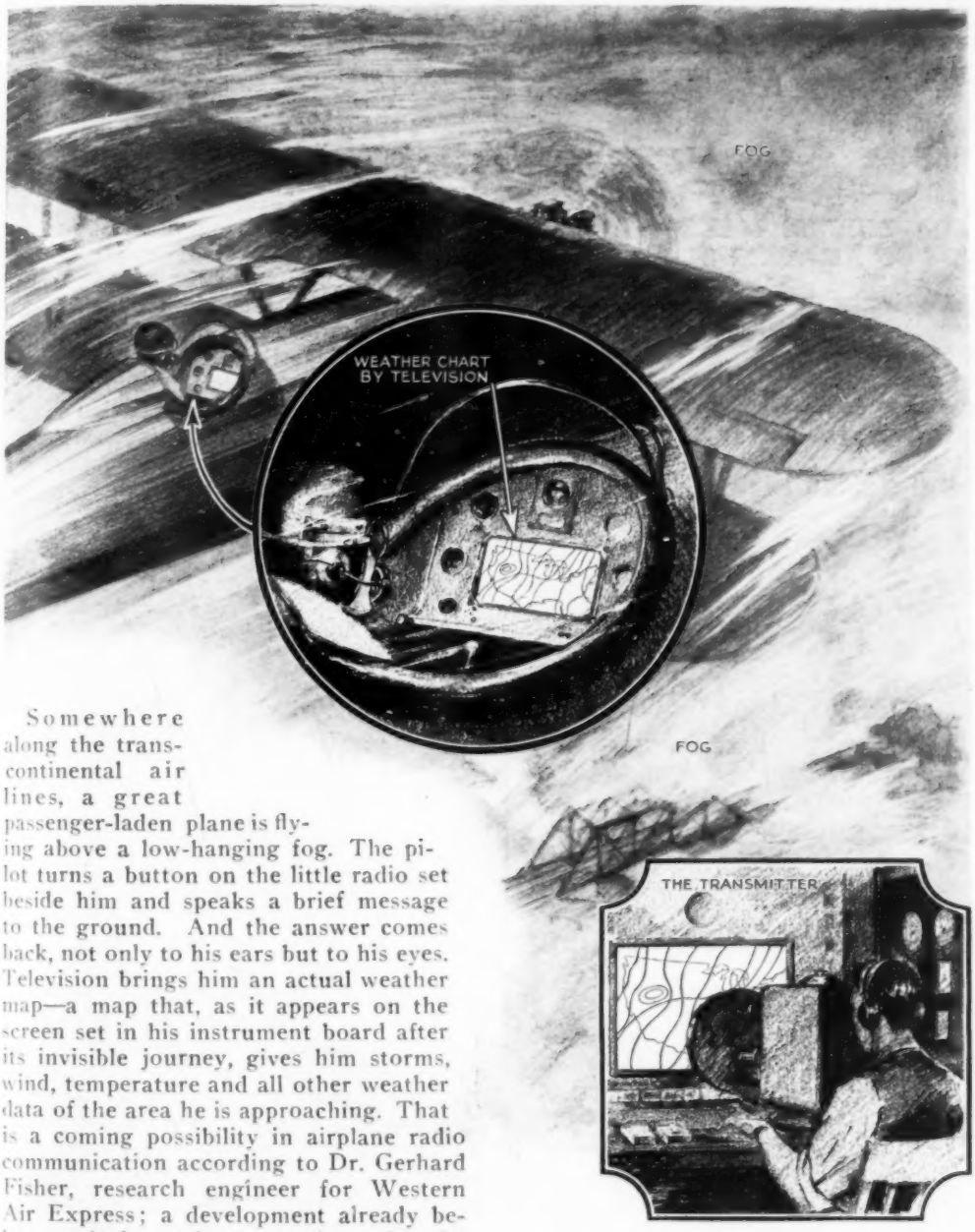
To satisfy his curiosity, a pilot making weather tests above the Cleveland airport recently flew his airplane into a thunder cloud to find what was inside. The interior, he quickly discovered, represented anything but ideal flying weather. Describing his experiences, he said tremendous air forces gripped his ship and shot it upward at 1,400 feet a minute, pushed it sidewise at nearly seventy miles an hour and released the plane as it reached the top of the cloud. The pilot, flying blind, attempted to dive until his air speed indicator showed 165 miles an hour, but still the ship rose with the air current. A little later, he picked another smaller cloud, and found it even worse, the updraft carrying him to the mushroom top of the cloud where the ascent stopped so suddenly that he was almost catapulted out of the plane.

PORTABLE HEATER USES A VARIETY OF FUELS

Gas, electricity, kerosene and other fuels can be used in a portable water heater now on the market. Heat is applied to a water chamber of copper, and when the water gets hot, it passes up a feed pipe into a reserve tank. From there it flows into a tubular radiator core, through which are passing air currents propelled by a fan. The hot water heats the air currents which are circulated about the room, providing warmth of the desired degree. This process of heating the air also cools the water, which returns to the copper chamber through another pipe. There are no boilers, and the operating cost is low. The heater can be carried with ease.



Pilots Soon to See Weather by "Radio Eye"

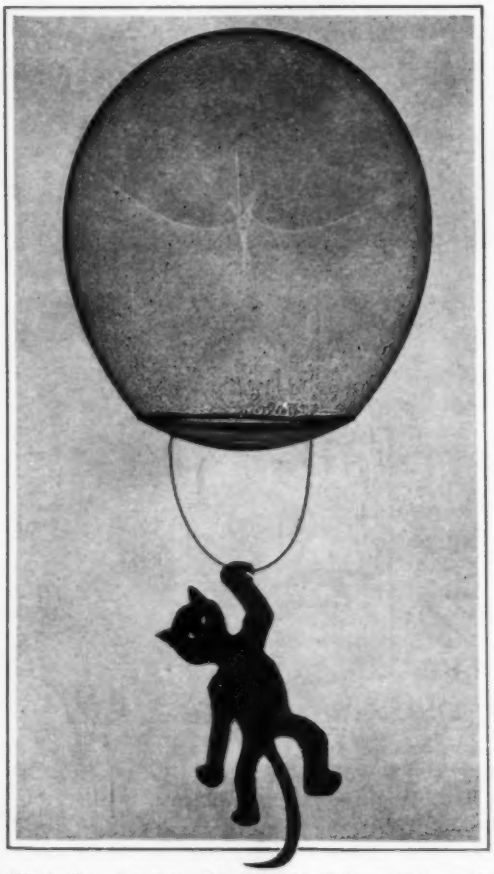


Somewhere along the transcontinental air lines, a great passenger-laden plane is flying above a low-hanging fog. The pilot turns a button on the little radio set beside him and speaks a brief message to the ground. And the answer comes back, not only to his ears but to his eyes. Television brings him an actual weather map—a map that, as it appears on the screen set in his instrument board after its invisible journey, gives him storms, wind, temperature and all other weather data of the area he is approaching. That is a coming possibility in airplane radio communication according to Dr. Gerhard Fisher, research engineer for Western Air Express; a development already being worked out in connection with the highly sensitive and compact receiving set he has just perfected. With the growth of the airline network over the country, came the development of chains of radio stations on the ground, but still a transcontinental plane on its long journey had to carry on its communication in a hop-skip-and-jump fashion; losing one ground station, picking up another, losing that, reaching out for the next one. With the average receiving set, even the type built especially for airplanes, 200

miles was the limit for voice communication. Experts could and did make sets powerful and sensitive enough to talk and hear more than 200 miles, but they weighed too much to be practical in a plane. So Doctor Fisher set himself the problem of cutting down weight. On an actual test in a plane, his voice traveled more than 700 miles over mountains, deserts, farmlands and cities. A little dot in the sky talked with another little dot, while both were racing along at 125 miles an hour. The new receiving set is a six-tube short-wave affair, with every ounce of unnecessary weight eliminated. Instead of operating on the regular electrical equipment of the plane, the set uses its own small but powerful battery.

SOAPBUBBLE MAKES BALLOON OF AMAZING STRENGTH

To determine the tensile strength of a soapbubble and its ascensional power when blown up with hot air, the bureau of standards recently carried out a number of experiments, one of which was to attach an aluminum-wired ring to a huge soapbubble and, with a cat cut from cardboard attached to the ring, make an ascension. The wire ring was attached by first soaping it and then pushing it against the bottom of the bubble, where it clung. It was found that the bubble, in comparison with its filmy thickness, has an amazing tensile strength, particularly if glycerine is added to the soap solution. It is so strong that even gasoline vapor may be exploded inside it without it bursting, the bubble merely expanding from the explosion.



Black Cat, Cut Out of Cardboard, Takes a Ride on a Soapbubble Balloon

PROPER CARE OF YOUR WATCH ADDS TO ITS ACCURACY

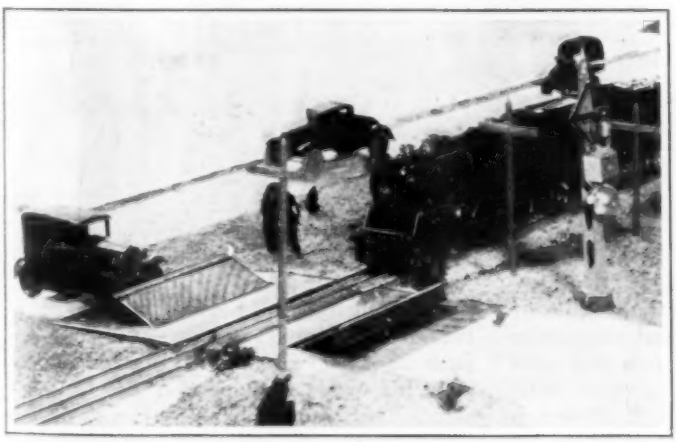
Proper care of your watch, such as regular winding and correct handling and carrying, will add greatly to its accuracy. The winding, which should be done at the same time every day, must be made steadily and not too rapidly, and its conclusion should be approached carefully to avoid injury to the spring or winding mechanism. The United States bureau of standards points out that an hour's delay in winding may cause considerable variation in the rate of movement. The watch also varies according to temperature and amount of jar. For instance, a watch carried in the upper coat pocket generally is at a lower temperature and is more frequently disturbed, as well as being held in various positions more irregularly, than in other pockets. This causes loss or gain in time. In a large pocket the watch is apt to turn to the right or left by various amounts, giving irregular rates of movement unless some method of holding it upright is adopted. Perhaps the best method is to keep the watch in a chamois or kid watch bag, such as may be obtained from jewelers, in correct size to fit the watch. The friction of the bag prevents it from turning, while the bag protects the watch and keeps it clean.

NAVY BUILDS SECRET PLANE TO SEEK SPEED RECORD

World speed supremacy in the air is the objective of engineers who are constructing an airplane engine in secrecy for the United States navy to enter in the 1933 Schneider-cup races. The engine is expected to carry a plane faster than the 375-mile an hour ship Great Britain is entering in this year's race. All details of the new motor are being closely guarded. Great Britain won the 1929 title with an average speed of 328.06 miles an hour. The United States has not won since 1925. The races are held every other year.

RAILWAY BUMPER STOPS AUTO WHEN TRAIN IS COMING

Automobiles are blocked off railroad tracks by a crossing guard which is operated automatically by an approaching train. A model, approved by railway and safety engineers, presents the guard as a steel platform which tilts as it rises from the road on either side of the tracks. The side facing oncoming traffic really is a bumper, equipped with shock-absorbing springs, built to stop an automobile traveling twenty-five miles an hour without serious damage to car or occupants. Autos going at a greater speed also will be halted, with far less damage than if struck by the train. By tilting the guard from the inside, a car already on the crossing can drive off the tracks, thus eliminating the hazard of being trapped by the train.



Steel Barrier or Bumper Shown Rising from the Roadway to Stop an Automobile About to Cross the Tracks in Front of a Train

Rubber Bathing Cap Fitted with Suction Cups around Inside of Rim to Keep Out Water

SUCTION CUPS ON BATHING CAP KEEP OUT THE WATER

Rubber bathing caps with suction cups inside the rim cling to the head of the wearer and keep out water, sand and dirt. The caps have three parallel rows of tiny cups about the edges which, when moistened, adhere firmly to the skin. The headgear is held in place with a band.

ELECTRIC "CHAIR" FOR INSECTS HAULED THROUGH FIELDS

One Nebraska farmer this year saved his crops when they were menaced by grasshoppers by building a portable electric "chair" which killed them by the bushel as it was hauled through the fields by a tractor. The insect destroyer consisted of a system of wires running parallel on a wooden frame and connected to a battery with step-up coils to increase the voltage. The wire frame was mounted on the front of an automobile or tractor.

Homing Pigeons Are New Oil-Well Scouts

Pigeons Carrying Messages Are Being Released by Oil-Well Workers in Picture at Right; Above, Message Being Received at Operator's Headquarters

Homing pigeons are being used by an oil producer in Texas to carry reports of progress from oil wells in new or "wildcat" territory to headquarters. The producer, when he introduced the pigeon messenger to the oil fields, was drilling a well 100 miles from his offices, in a district almost impenetrable to autoists. The nearest telephone was twenty-four miles away over a road that was bad in wet weather. In spite of this situation, it was essential that daily reports from the drillers reach the producer. So he pressed the pigeons into service. Each day the drill foreman writes out his reports, attaches them to the metal tube on a pigeon's leg and releases the bird. Within two hours, the pigeon reaches his home loft, near the company's offices.

FEWER FLYERS HAVE TO JUMP INTO CATERPILLAR CLUB

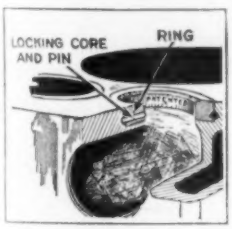
Only thirty-four new members were added to the Caterpillar Club the first six months of 1931, as compared with sixty-five in the same period of 1930. This organization, composed entirely of involuntary members—those who have had to jump from airplanes to save their lives—has twelve members who have had to jump twice. Among these is Lieut. "Jimmy" Doolittle, who became a member of the club during the Cleveland air races in 1929. He "took" his "second degree" June 23, 1930, when the fabric tore loose from his wings at a speed of 235 miles an hour. The "monarch" of the club still is Col. Charles A. Lindbergh, who has four emergency jumps to his credit.

CAR DETECTS BAD RAILS AS IT RUNS OVER TRACK

Defective rails that track walkers are unable to spot are located and marked by a self-propelled railway car that detects faulty places as it moves along. This mechanical safety patrolman moves over the track at about six miles an hour and operates on the principle that an electric current flowing through a rail must pass around any break in the metal. The car records this electrical deviation and marks the bad spot with a streak of paint. The human eye can see breaks or cracks extending to the surface but the detector car finds faults within the steel itself.

VALVE SEATS LOCKED IN PLACE WITH CEMENT

Valve seats that can be permanently locked in position are being supplied for gas and gasoline engines as replacements for those that have been worn, cracked or burned. After the old seat has been cut out, a recess is bored in the block casting just large enough to receive the valve-seat ring. In the recess and near the bottom, a circular groove is cut in the wall to coincide with the groove in the valve-seat ring and form a mold for iron cement. The ring contains a number of small holes about the groove, each fitted with a sliding steel pin. The cement is used in the plastic state and is placed in the recess and groove in the block and in the groove in the ring before it is driven in, the surplus being squeezed out to leave a circular cement core into which the steel pins are driven to seal, level and lock the valve seat in place. The cement has about the same degree of expansion and contraction as cast iron and eventually becomes as hard as the iron itself.



Gate to a Drydock in Boston Navy Yard as It Looked When Placed on the Marine Railway for Repairs

DRYDOCK GATE LIKE BIG BOAT IS OVER THIRTY FEET HIGH

Visitors to the Boston navy yard recently observed a huge structure that might easily have been mistaken for the hull of a big ship or a giant rocket standing on end. Instead, it proved to be the gate to a drydock which was placed on the marine railway for repairs. It towered some thirty feet above the runway.

SEE YOURSELF LIKE OTHERS DO IN RIGHT-ANGLE MIRROR

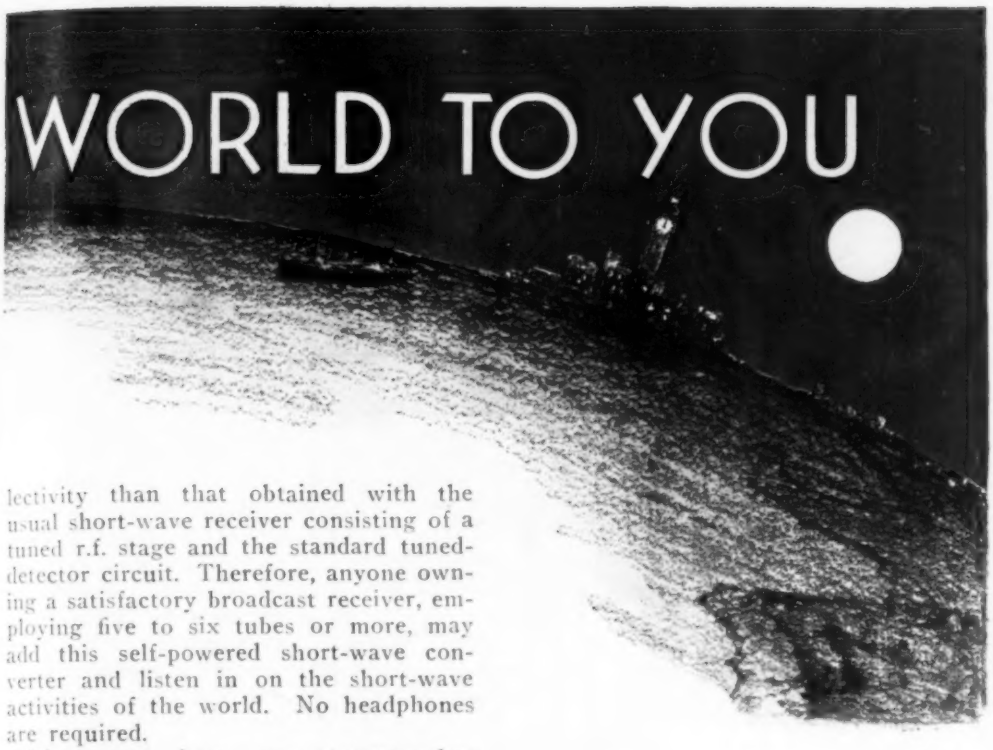
Seeing yourself as others see you is possible now by looking directly into a mirror invented by Prof. Elihu Thomson. This mirror, which has twin glasses set at right angles, reflects a double reverse image, or exactly as the person appears to others. Print held before the ordinary mirror reads backward.

This MAGIC BOX brings

By R. E. DAVY

USING the common broadcast receiver without making any changes in the installation except to shift the antenna and ground connections, this magic box spans oceans and continents. The efficiency of the superheterodyne circuit, especially for short waves, is established and this converter makes a short-wave super out of the modern receiver. The converter supplies the oscillator and first detector, and the broadcast receiver the intermediate-frequency amplifier, second detector and audio amplifier.

Excellent selectivity is obtained with this arrangement, although the selectivity depends somewhat on the same quality in the broadcast receiver. The modern broadcast set provides 10 to 20-kc. station spacing, and this band-pass effect allows needle-sharp tuning with the converter. Fairly broad-tuning receivers will give even greater se-



lectivity than that obtained with the usual short-wave receiver consisting of a tuned r.f. stage and the standard tuned-detector circuit. Therefore, anyone owning a satisfactory broadcast receiver, employing five to six tubes or more, may add this self-powered short-wave converter and listen in on the short-wave activities of the world. No headphones are required.

The super short-wave converter has another advantage in that, when receiving modulated signals, extremely fine tuning may be obtained by adjusting the controls on the broadcast receiver.

Owing to the small size of the converter and the simple connections, it may be tucked under the arm and tried out on your friends' receivers with a minimum of trouble as shown in the upper photo on page 647. To make the connections, merely remove the antenna and ground leads from the receiver and connect them to the corresponding posts on the converter. A second antenna post on the converter is then connected to the antenna post on the receiver with a short lead, and the power supply to the converter is plugged into a convenient 110-volt a.c. outlet. When plugged into a lamp socket, no other external switch is necessary, but, when plugged into a service outlet, a snap switch in series with the power-supply lead, near the converter, will be found convenient.

Tuning is extremely simple. The broadcast receiver is turned on and the volume control turned full on. Tune to a point on the broadcast set where no stations are heard, which is usually found at the extreme top or bottom of the dial. Now slowly rotate the dial on the converter until a short-wave station is heard. The signal volume may then be regulated with the volume control on the set. Try different dial settings on the broadcast set for best reception, bearing in mind that each

What IT WILL *Do*

HERE are some of the things this short-wave converter will bring in on the loud speaker of your present set:

The chimes of "Big Ben" in London and programs direct from all parts of Europe.

Mexico, Cuba and Australia are easily within your reach.

Liners talking at sea, explorers in distant lands, airplanes and time signals.

It will open a new radio world of romance and adventure to you.

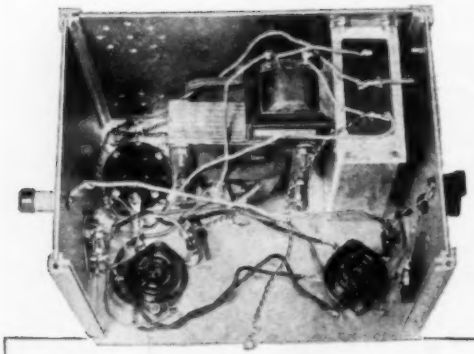
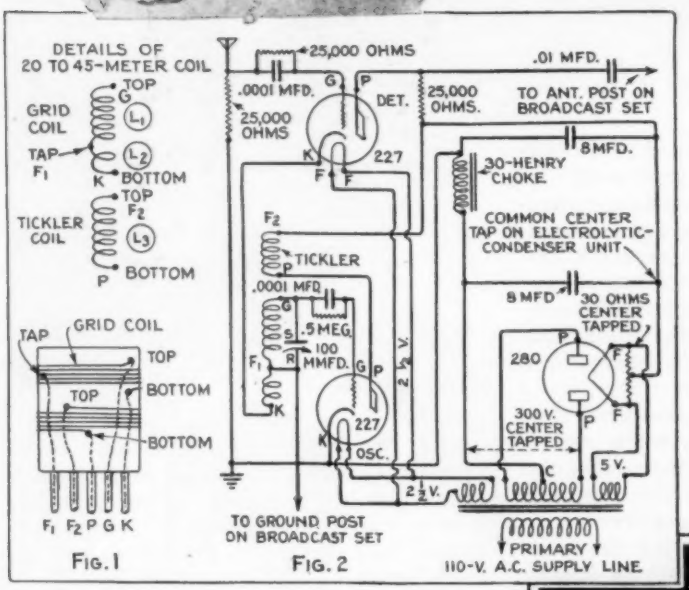
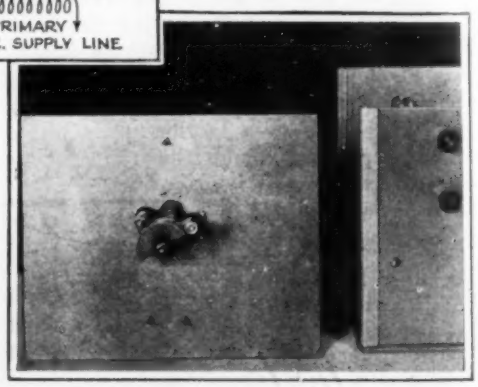


plate supply, is housed in a non-magnetic can, 5½ in. deep, 7⅝ in. long and 6 in. high. This can is made up in the usual stage-shield manner, employing four slotted corner posts to hold the sides, while the top and bottom plates overlap. Machine screws in the corner posts at top and bottom hold the assembly together. This construction is clearly shown in the photos. The top and bottom plates are 6 by 8 in., the sides 6 by 5½ in., and the front and back panels, 6 by 7½ in. All these panels are cut from .088 gauge eraydo or aluminum stock, and the aluminum corner posts are 6 in. long.

Looking at the assembled can from the rear, a hole is drilled just above center to take an insulating grommet through which the power-supply cord is to be passed. A series of small ventilating holes are drilled near the right edge, at top and bottom. Viewing the can from the front, the left-side panel is drilled to take





change of the dial on the broadcast receiver also changes the intermediate-frequency, thereby causing a change in the dial reading of the converter. However, when the best setting on the broadcast receiver has been found, short-wave stations can be logged on the converter and will be found at the same dial reading each time.

When using the converter with a broadcast superheterodyne receiver employing an antenna choke coil, the antenna lead from the converter should be connected directly to the plate of the first r.f. tube in the receiver. When used with superheterodyne sets without the r.f. choke, the antenna connection is made to the first detector plate. These exceptions refer to superheterodyne receivers only.

Now for the construction details. The converter, including its own filament and

the single insulated antenna binding post, and a cut-out is made for the five-contact socket for the plug-in coils. This side view is given in the lower photo on page 647. An insulated binding post for the antenna lead from the receiver and a binding post grounded to the can, for the ground lead that formerly went to the receiver, are mounted on the right-hand

side of the can, as shown in lower photo on page 646. The midget tuning condenser is mounted at the center of the front panel, as shown in the same photo.

The plug-in coils are wound on five-prong tube bases obtained from burned-out tubes. These coils are detailed in Fig. 1; the coil tuning from 20 to 45 meters is wound with No. 24 s.s.c. wire; L_1 is 5 turns; L_2, continuing from L_1, is 1½ turns, and the tickler coil L_3 consists of 5 turns wound in the same direction and spaced ¼ in. from the bottom of L_2. The 40 to 90-meter coil is wound with the same kind of wire, 12 turns for L_1; 1½ turns for L_2 and 10 turns for L_3. The coil tuning from 85 to 160 meters employs No. 32 s.s.c. wire for coils L_1 and L_2, 30 turns for L_1 and continuing on for 2 turns for L_2, while L_3 consists of 25 turns of No. 36 s.s.c. wire.

From the schematic diagram, Fig. 2, it will be noted that no r.f. chokes are employed in any part of the circuit. Fixed resistors are used instead to eliminate most of the trouble usually encountered in building converters owing to the large distributed capacity generally present in such chokes. An added advantage of this method is the uniform response over the entire dial range with extreme sensitivity.

The simplified wiring diagram shows each part in its relative position within the can, and both diagrams may be had in enlarged form if desired. Complete material lists also are

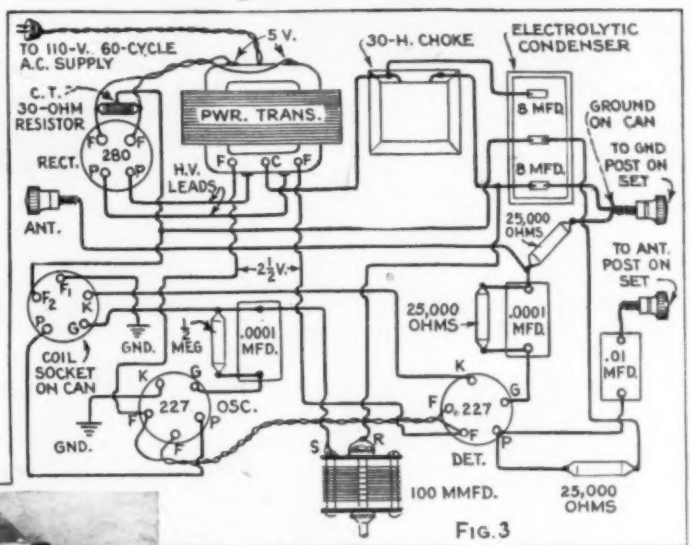
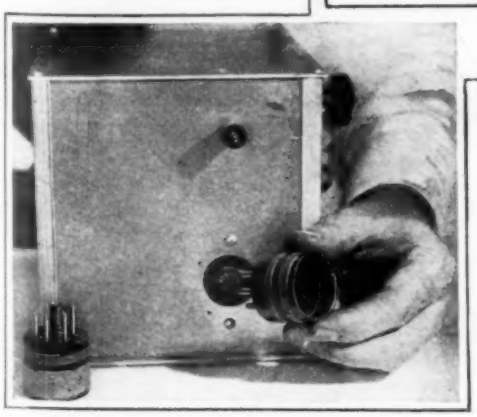
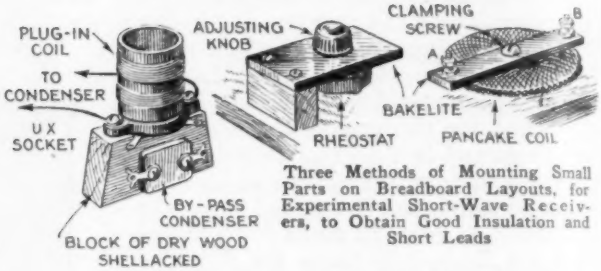


FIG. 3

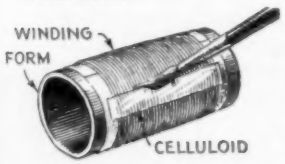


available to all, and none of the parts are expensive. The tube sockets, power transformer and electrolytic-condenser unit are mounted directly on the base of the can, and the base of the filter choke is soldered to the metal container of the condenser unit, near the top. This makes a very compact assembly, as shown in the upper photo on page 646. Long leads terminating in lugs for the tuning condenser enable the insertion of the front panel after all wiring has been completed.

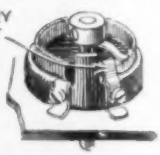
Practical Ideas



Three Methods of Mounting Small Parts on Breadboard Layouts, for Experimental Short-Wave Receivers, to Obtain Good Insulation and Short Leads

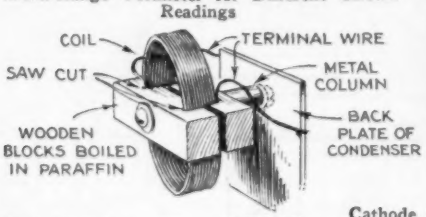


Left, Short-Wave Coils May Be Strengthened by Means of Three or Four Celluloid Strips Fastened with Collodion before Removing Coil from Form



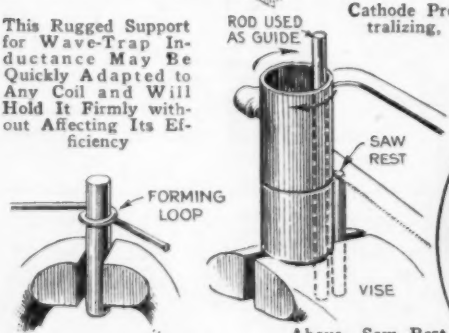
Right, Added Strip-Brass Contact Cuts Out All Resistance When Full Current Is Required

Small Double-Pole-Single-Throw Switches Mounted on Transmitter Panel to Shift Multi-Range Voltmeter for Different Circuit Readings

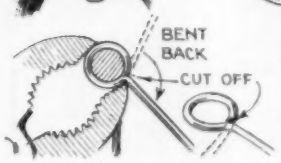


Cathode Prong Clipped from 227 for Neutralizing, for 226-Clip Filament Prong

This Rugged Support for Wave-Trap Inductance May Be Quickly Adapted to Any Coil and Will Hold It Firmly without Affecting Its Efficiency

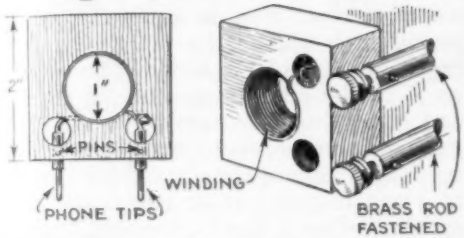


Above, Saw Rest and Guide for Cutting through Bakelite Tubing Squarely



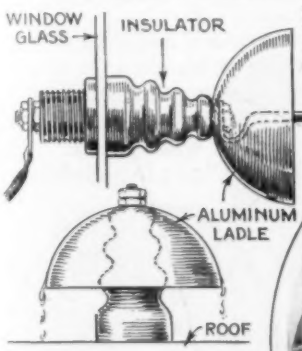
Left, Quick Method of Forming Heavy Copper Wire into Neat Terminal Loops; Above, Y-Type Spring-Suspended Socket for Panel Mounting Is Provided with Drilling Template

for the Radio Experimenter

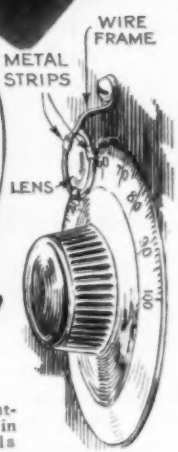


Fragile Short-Wave Coils Inserted in Wood Blocks, Boiled in Paraffin, Are Easily Mounted as Shown

Portable Output Meter Handy for Checking Receivers and Public-Address Systems

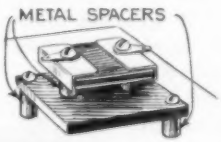


Above, Aluminum Ladle Used as a "Corona-Shield" on Amateur Transmitter Line Insulator; Lower Sketch Shows Same Idea for Rain Shield



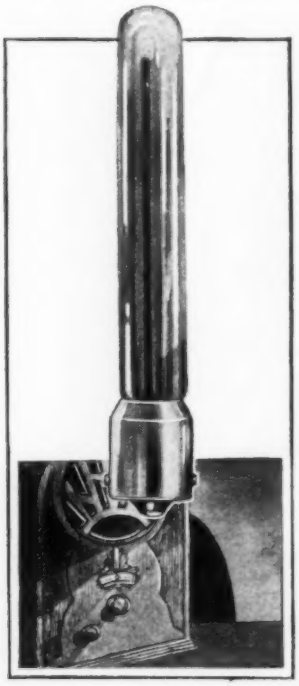
Right, Small Lens Mounted in Wire Frame Aids in Reading Precision Dials on Testing Apparatus

Below, Handy Spring-Clip Brackets for Mounting Large Vitrified-Type Resistors in Amateur Power Units



Left, Homemade Mounting Bracket for Fixed Condensers or Other Parts That Must Be Well Insulated from the Metal Chassis; the Base Is Made from Scrap Bakelite Supported above the Chassis by Short Pieces of Brass Tubing through Which Machine Screws Are Inserted

Column of Light Aids in Tuning



The illuminated method of visual tuning is similar to the meter system recently introduced, where the dial is rotated for the greatest swing of a needle. In this case, a column of brilliant light rises, in a gas-filled tube, to its maximum height when the station is accurately tuned in and then gradually diminishes as the station is passed. The tube is inserted in a bayonet socket which is mounted directly above the tuning dial. Extraneous noises, such as static or other electrical disturbances, do not influence the light column. Thus the speaker can be cut out with a switch while tuning across the dial, so that no signals are heard until the desired station is located.

Uses for Old Condensers

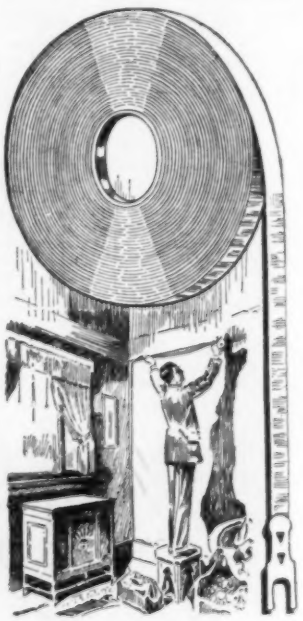
Variable condensers salvaged from obsolete receivers are useful additions to the experimenter's junk box. They may be altered to fit into experimental hook-ups where the builder does not care to go to the expense of new condensers until after test. For short-wave receivers many of these old broadcast condensers may be torn down and made over for lowered capacity. Stator plates need not be removed; for the average short-wave receiver, remove all the rotary plates, except two or three, in such a manner that the remaining plates are evenly spaced. The discarded plates may be cut up and used to make small angles, connecting strips and other radio hardware. These plates may have been coated with lacquer, and this must be removed before making soldered connections. The brass columns may be used for supporting coils or as shafts for vernier condensers.—R. J. Plaisted, Brecksville, Ohio.

Magnetic Speaker as Microphone

A magnetic cone speaker may be used as a microphone for home broadcasting, on a receiver that is equipped with a phonograph pickup, by merely connecting it in place of the latter. The voice is amplified by audio stages of the receiver and issues from the speaker in the set at greatly increased volume. The speaker used as a microphone should be placed at some distance from the reproducing speaker.—Leo J. Sands, Everett, Wash.

Antenna Sticks like Adhesive Tape

This handy antenna is rolled up like ordinary friction tape with the clip that fits under the set binding post attached to the end as shown. It consists of a 50-ft. strip of metal foil backed with rubber adhesive. To install, the clip is fastened to the set, the antenna is unrolled with one hand and pressed against the wall, or baseboard, with the other. It is extended until the particular set in use shows the proper selectivity and may then be terminated. It is claimed, that the entire 50 ft. is not required, owing to the high capacity and inductance of the antenna.



¶For further information on any radio construction article write to the radio department; this service is free.

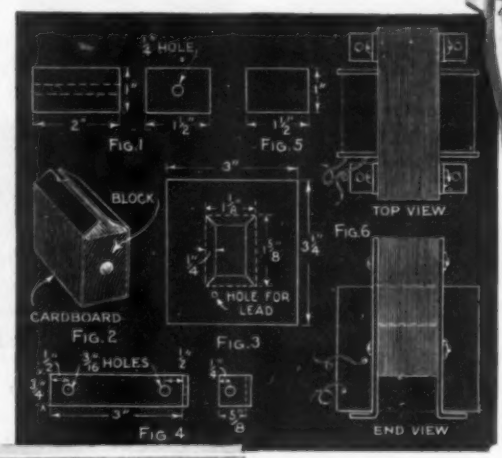
Building a Heavy-Duty Filter Choke

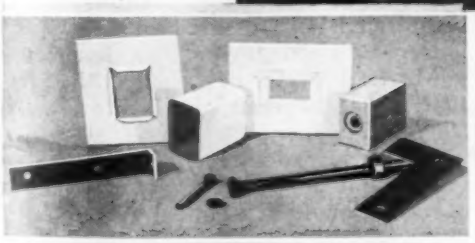
By S. H. BURNS

MANY filter chokes with inductances ranging from 20 to 30 henrys have this value only when carrying comparatively little current. A good heavy-duty choke must carry and filter at least 80 or 90 milliamperes in the power-supply unit of a modern radio receiver.

The choke to be described, which can be built by any experimenter at small cost, has a 30-henry inductance when it is carrying 100 milliamperes. Various filter circuits require different choke arrangements, and these variations have been provided for in the construction details.

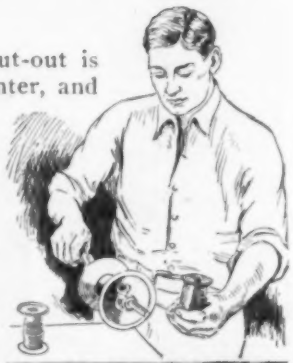
The coil is wound with many turns of enameled wire on a form, or spool, that will hold it in shape while being wound and assembled. A wooden block for this purpose is detailed in Fig. 1 and is 2 by 1 by 1½ in., the 1-in. dimension being made a little full to give ample room for the laminated core. A ¼-in. hole is drilled through the length of this block. The center portion of the bobbin, or spool, may be made





from a piece of cardboard, 2 in. wide. The joint should be along the center of the 1-in. edge and must be a butt joint as shown in Fig. 2.

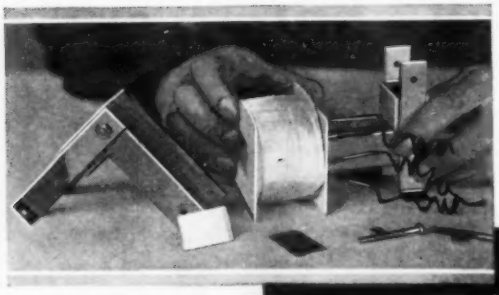
The ends of the bobbin are cut from two pieces of 1/16-in. cardboard as detailed in Fig. 3. A cut-out is made at the center, and the corners are slotted to fold back on the dotted lines. These pieces are slipped over the form at each end with the flaps toward the inside. The flaps are then glued in place with the outer edges parallel



to the ends of the wood block, and a layer of tape is wound over the surface of the bobbin.

Two pieces of cigar-box wood, 3 by 3¼ in., are used to strengthen the cardboard ends while the coil is being wound. A ¼-in. hole is drilled in the center of each of these pieces. To assemble the bobbin for winding, a ¼-in. machine screw, 3½ in. long, is required. This is inserted through the wood endpieces and the block. Large nuts hold the assembly together so that the bobbin cannot rotate on the screw.

A coil winder with a turn counter should be used, but if this is not available, a hand drill clamped in a vise will do. In this case, the gear ratio of the drill is determined. For example, if one turn of the handle revolves the chuck four times, only one-fourth as many turns of the handle



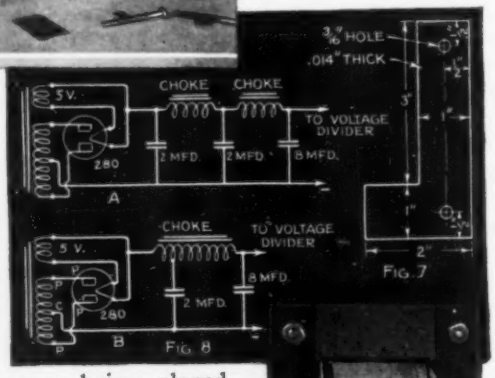
are needed to wind the coil as there are turns on the coil. It is made up of 7,400 turns of No. 30 enameled-copper magnet wire. The turns are wound evenly in layers, thin sheets of insulating waxed paper being placed between adjacent windings.

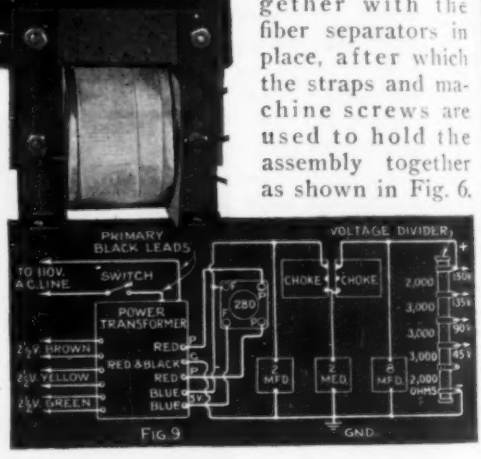
The first coil to be considered is the 30-henry choke without taps. Two such chokes are used in standard filter systems. To start the winding, remove the enamel insulation from one end of the wire and solder to it a 12-in. lead of rubber-covered wire. Pass this lead out through the hole drilled in the endpieces, as shown in Fig. 3, and cover the soldered joint with tape. When the total number of turns have been made, solder on another length of rubber-covered wire and bring it out. The finished winding is then covered with a layer of tape, after which the screw and wood parts of the form are removed from the coil.

Before taking up the details of the core, other types of coils will be described. The coil for a center-tapped choke is practically the same as the one described with the exception of the center tap. This tap is soldered to the 3,700th turn, and is brought out through a hole in the coil end in the same manner as the lead at the start of the coil. The method of joining the lead without cutting the wire is shown in the upper photo on page 651.

For a choke-input filter, the tap is so located that the first section of the coil will have an inductance of about 6 henrys, and is soldered to the 2,600th turn.

The core is made up of thin steel laminations, which are available, in the shape shown in Fig. 7, already punched and ready for assembly. Four straps of ⅛-in. brass or aluminum, as detailed in Fig. 4, are needed for assembling the core. About 210 laminations are required, and these are divided into two equal piles. When assembling the core, an air gap of .022 in. is maintained at each joint. Fiber strips, cut as shown in Fig. 5, are used, and two are required for each core. One pile of the laminations is inserted in the coil and the other butted together with the fiber separators in place, after which the straps and machine screws are used to hold the assembly together as shown in Fig. 6.





At A, Fig. 8, two straight chokes are employed, and B gives the circuit for the choke-input filter. Fig. 9 shows two of the straight chokes used in a complete power unit employing the homemade power transformer described in the May, 1931, issue, diagrams of which are available.

The filter condensers shown in the diagrams should be capable of continuous operation on 400-volt direct current.

Quieting a Noisy Volume Control

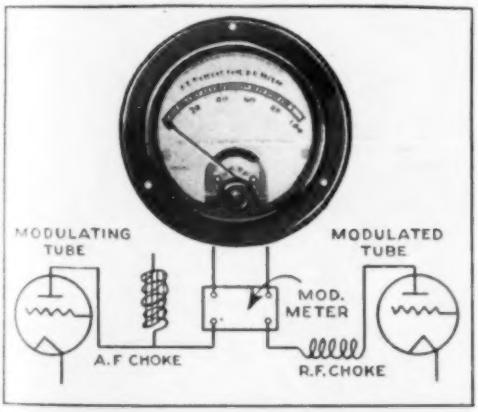
Crackling sounds, which occur when the volume control is adjusted, may be eliminated by applying a little machine oil to the resistor winding. This can be done with a brush or strip of paper.

New MU-Tube Is Variable

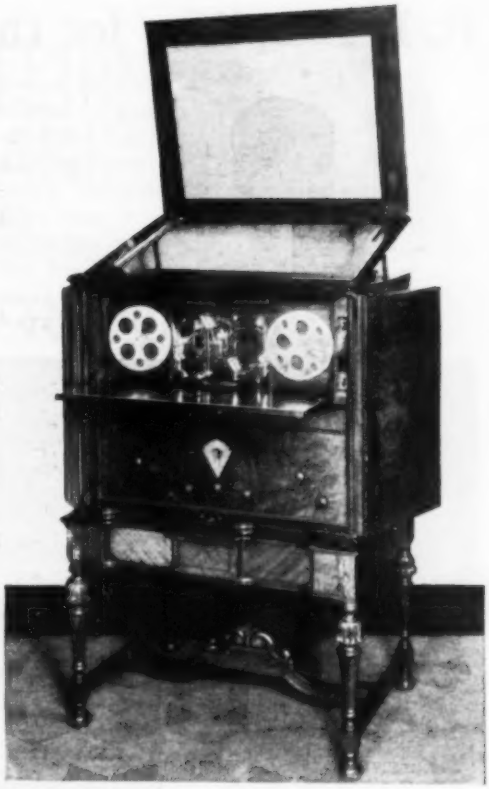
Designed for more uniform performance, and for the simplification of modern receiver circuits, the new variable MU screen-grid tube is coming into general use. It permits stronger signals to be fed into the r.f. amplifier without causing "cross talk." Hence the ratio of the desired signal to the noise level is raised, eliminating hissing common in sets employing several pre-selector stages. One of the most important advantages of using this tube is that it eliminates the need for various controlling devices heretofore employed to compensate for the difference between distant and local signals. In a set employing the new tubes, there is no need for the antenna and ground shunting potentiometer, the local-distance switch, the double pre-selector and other compensating means.

Meter Indicates Effective Phone Output

Amateurs operating radiophones may now read the percentage of modulation directly, keeping a continuous check on the effectiveness of the station output. The model-558 Weston meter used is a rectifier type with the scale calibrated in percentage of full modulation of the transmitter. The complete unit consists of the meter and an external shunt box with four binding posts. Two of the latter are connected in the plate circuit of the modulated tube, and the other two to the instrument, which may be placed at any convenient location.



Modulation Meter, and Diagram Showing Its Position in the Radiophone Circuit



Home Talkie and Radio Installation Showing Film Reels and Screen in Position

Home Movies Combined with Radio and Phonograph

All in one compact unit, this radio and home-talkie installation provides about all anyone could expect in the way of entertainment with the exception of television. Either the phonograph or radio may be used without the pictures, or the pictures may be shown in combination with either radio or sound effects. A turntable is so arranged that it can be operated at 33 revolutions per minute, which is the speed used for talking pictures, or 78 r.p.m., the speed for phonograph records. The threading of the 16-millimeter film is simple, and can be done by anyone after a few minutes of instruction. Quickly placed in operation, it is recommended for schools, clubs, children's camps, etc.

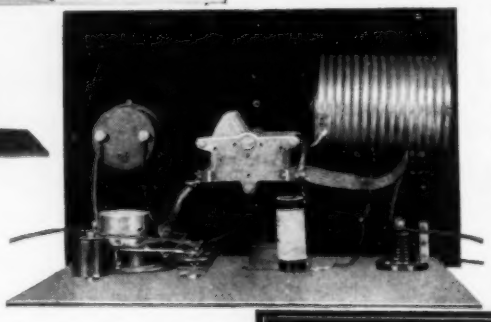
Blueprints covering radio construction articles in past issues can be obtained for 25 cents each; material lists are always available without charge.

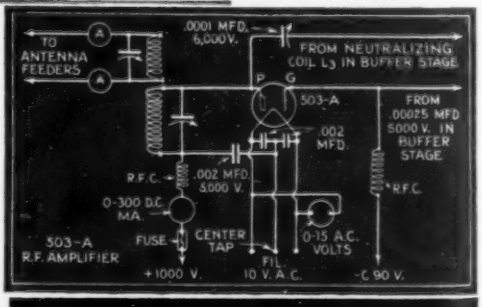
R. F. Amplifier for the Amateur Transmitter

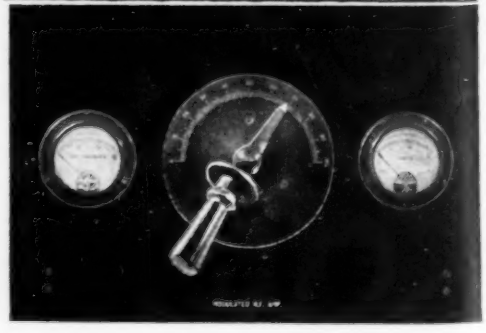
One or more stages of amplification are necessary for the maximum power output of a crystal-controlled oscillator. The modulated r.f. amplifier, to be added to the output of the buffer stage in the unit described in the September issue, is quite simple. It is tuned to the same crystal frequency in the 80-meter band and may be doubled to 40 meters as desired. This 503-A r.f. amplifier, added to the oscillator and buffer stage, makes an ideal 50-watt short-wave transmitter when keyed in the center-tap lead of its filament supply. The separate antenna-tuning condenser and coupling coil are shown in the upper photo. Only one 1.5-amp. thermocoupled antenna ammeter is required, but two may be used if desired; the capacity of the antenna-tuning condenser is .00045 mfd. The coupling-coil inside diameter is 3¼ in. and consists of 9 turns of ¼-in. copper tubing. It is mounted on a hinged, bakelite bracket to be fastened to the transmitter frame near the tank coil. The adjustable 12-in. bracket permits simple coupling and easy clip-lead alterations. The r.f. tank condenser is a heavy-duty type of .00033-mfd. capacity. The tank coil consists of 15 turns, of the above dimensions, wound in the same direction. It is mounted on porcelain stand-off insulators on the panel directly behind the plate milliammeter. The r.f. choke coil in the high-voltage lead consists of 100 turns of No. 30 s.c.e. wire wound on a bakelite tube 1 in. in diameter. The other r.f. choke may be an S-M 277 or similar type. The bakelite front panel is ¼ by 17⅜ by 11½ in. The .0001-mfd. neutralizing condenser, not shown in the photo, is mounted on porcelain stand-off insulators in an upside-down position on the underside of the speech amplifier unit above. It is placed directly behind the 503-A tube.

The leads in the tank circuit should be as short and direct as possible. They are made with heavy copper braid and terminate in spring clips for adjusting the coil turns. The small fuse in the lead to the milliammeter is mounted on the stand-off insulator at the right.

(To Be Continued)



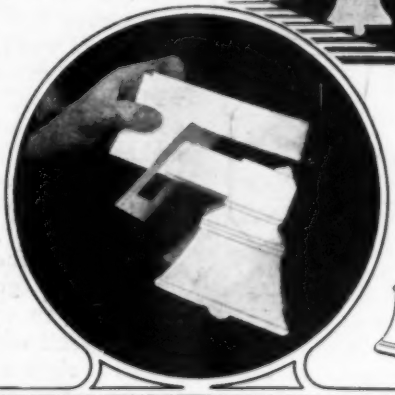




Fun with PAPER PUZZLES

ONE of the best of all paper brain-teasers is the bell puzzle. Cut an oblong piece of stiff paper or cardboard, fold it in the center, and cut a bell as shown in Fig. 1. Cut two pieces of paper to rectangular shape, each having a slot in the center. The opening in the smaller one should be too narrow for the bell to be passed through. You can easily gather the relative sizes of the various pieces from the details. Take the large rectangular piece and bend it over lightly in half, without creasing the paper, and then slip the small rectangle over the lower projecting arm. Next, open up the folded bell and slip it over the lower part, after which the small rectangle is slipped over the end of the prong and onto the bell. When the assembly is straightened out it appears as in the top photo. If the folding of the original bend has been carefully done,

Try to Unfasten the Bell; It's Easy When You Have Learned How



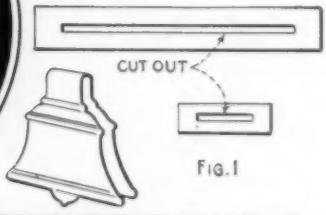
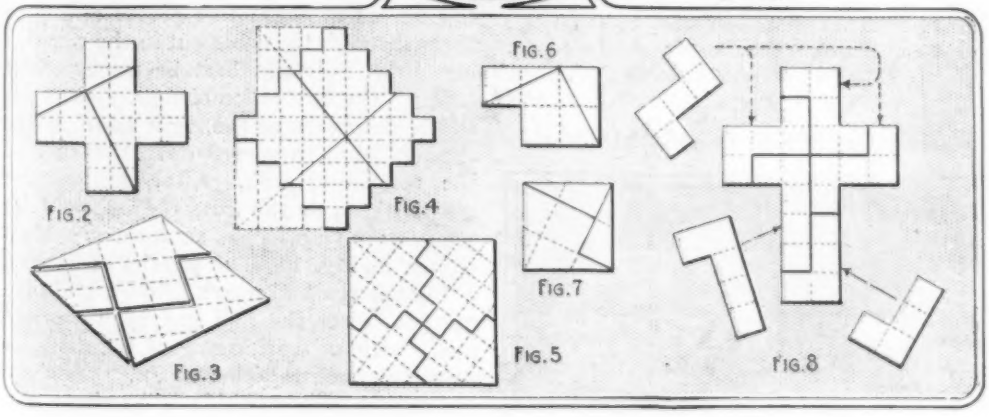


FIG. 1



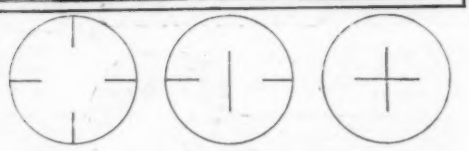


FIG. 9 SHORT CUTS = $\frac{1}{4}$ DIA., LONG CUTS = $\frac{1}{2}$ DIA.

FIG. 11

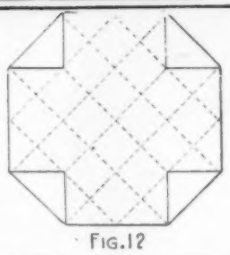


FIG. 12

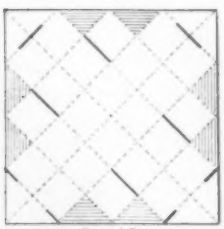


FIG. 13

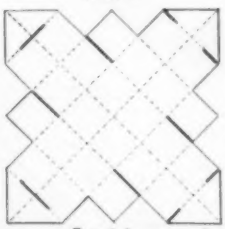
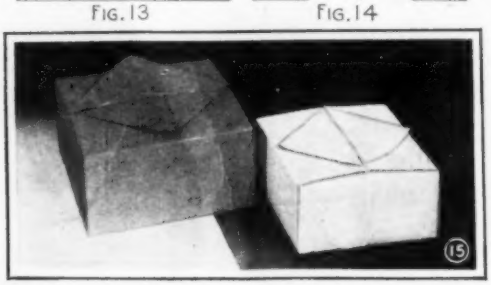


FIG. 14



no trace of a crease will be visible, and it will seem impossible to remove the bell from the crosspiece without tearing or bending it. The way of doing this is, of course, merely a reversal of assembling it.

The procedure in the construction of cut-outs, pictured in Figs. 2 to 8, is the same; the paper must be ruled to the proper shape, squared and cut out carefully. A soft eraser should be used to remove pencil marks. Request the spectator to divide the figure with two straight cuts so that the resulting sections can be placed together to form a square as in Fig. 3. Another tricky puzzle of this type is the "crisscross" puzzle, Fig. 4. Here, too, the paper must be divided into four pieces with two straight cuts so that the parts can be joined to form a square as in Fig. 5. The "House-and-Ell" puzzle, shown in Figs. 6 and 7, must also be placed together to form a square. Fig. 8 shows a Latin cross, which is cut out as indicated. In this case, the idea is to form a cross from three L-shaped and two other duplicate pieces cut out exactly as shown.

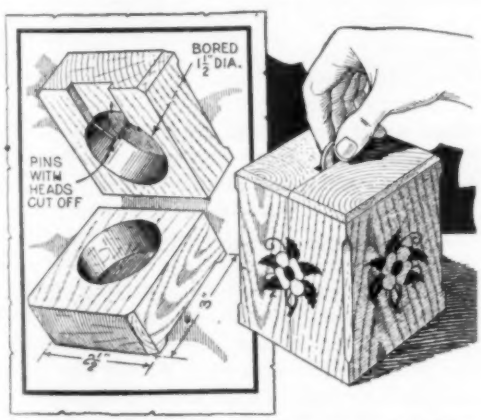
A clever little paper trick is the "Puff Ball," and you'll scratch your head in assembling it even after you are acquainted with the "how." Cut three circular pieces of stiff paper, about 3 in. in diameter, and make slits with a sharp knife or razor blade as indicated in Fig. 9. Lightly fold the two sides of the left-hand piece together and pass the upper half of this disk through the center cut of the second piece. After getting the paper through the slit, open up the fold, and you will find yourself with the two circular pieces joined at right angles. Then fold the four top halves of these two pieces and pass them through the cross cut in the remaining disk. This can best be managed by holding the folded ends lightly between the four fingers of the right hand, using the left hand to spread open the cuts of the remaining disk. After getting the pieces through the cut, they should be straightened up, so as to form a ball as shown in Fig. 10. The puzzle, of course, is to take the ball apart. And a still bigger job, after the ball has been worked apart without tearing any of the disks, is to put it back together again.

Another puzzle, which is based on the

same interlocking principle, is the "Puzzle Box." To make this, take a piece of paper 8 in. square and fold it diagonally from corner to corner each way. Then fold each corner to the center, as shown in Fig. 11. Open up the paper and fold each corner to the crease just made, as shown in Fig. 12; also make other folds as indicated by the dotted lines. Now cut out the shaded triangular portions as in Fig. 13, and also make slits in the paper as indicated by the heavy lines, forming a piece as in Fig. 14. All that remains to be done is to bring one corner over to the opposite corner, folding the sides of the former lightly so that they can be pushed through the slit in the latter. The fold is opened up after being pushed through the cut, and a similar operation is performed on the two other corners. This will give a neat little puzzle box like those shown in Fig. 15. The idea is to get the box open without tearing it.

A Small Wooden Bank to Save Your Dimes

Two wooden blocks, with 1½-in. holes drilled in the center and glued together, form a small coin bank that cannot be opened without destroying it. The holes are drilled to a depth of ¾ in. in each block, and a groove of suitable size is cut in one block for a slot. Four pins with the heads removed are driven at an angle into the blocks under the slot so that the coins cannot be shaken out. If desired, the bank can, of course, be made larger than the one shown here.



This Wooden Coin Bank Is Glued Shut and Cannot Be Opened without Breaking It

Baggage Held on Car by Means of Eyebolt Anchors Which Replace the Hinge Pins

Eyebolts in Car Hinges Provide Anchorage for Baggage Ropes

By removing the pins in the door hinges of your car and replacing them with eyebolts of the proper size, an anchor for fastening baggage ropes can be provided. The upper hinges serve for baggage on the roof of the car, while ropes holding baggage on the running boards can be tied to the lower hinges.

Golf Tee Replaces Button on Cable Release of Camera

When the steel button on the cable release of my camera broke off, I replaced it with the head of a celluloid golf tee. It was cut off about ⅛ in. from the head and a hole drilled in it to take the cable. The wire was roughened and cemented in place with ambroid cement, or, if desired, a cement of celluloid dissolved in acetone and alcohol with shellac added may be used.—H. C. Roberts, Urbana, Ill.

Estimating Weight of a Fish

If there are no scales at hand, the weight of a fish can be determined fairly accurately by measuring it. To do this, square its greatest girth in inches, multiply the result by its length, then divide by 800, and you will have its weight in pounds. The more symmetrical the fish is, the more accurate the estimate will be.—E. G. Thostenson, Ellensburg, Wash.

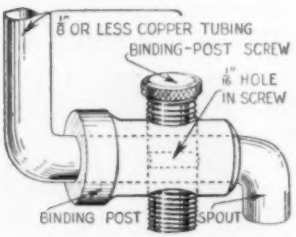
Removal of Refrigerator Drip Pan Simplified with a Truck

Refrigerator Drip Pans Easily Removed When Kept on This Truck, Made of Strap Iron

A drip pan can easily be removed from underneath the refrigerator by the use of a small truck, the dimensions of which depend on the type of pan used. The frame consists of two lengths of flat iron with holes drilled at each end for bolts which serve as axles for small wheels. Two similar pieces of flat iron are then bent at right angles at one end, and a suitable length of angle iron is riveted across the other ends, which prevents the pan from sliding off. These pieces are then riveted to the crosspieces and braced with a short length of iron attached diagonally.

Miniature Faucet for the Doll House

Here is a miniature faucet for a doll house, such as the one described in the February, 1931, issue of Popular Mechanics, where running water was installed. The faucet is made from a radio binding post and a length of copper tubing, bent at right angles at the end. Drill the binding post lengthwise to receive the tubing tightly. The hole on the side of the binding post is continued through the tubing and then the latter is sweated in place. Tap the hole to receive the knurled screw previously fitted at the end, making a tight fit, after which a 1/16-in. hole is drilled through the screw.

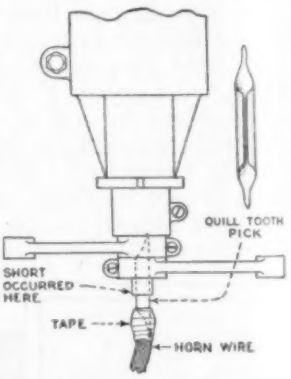


Two Window Shades Allow Fresh Air and Privacy

In order to have fresh air, light and privacy at the same time, the use of two shades on the same window has proved satisfactory. One short shade is attached to the top of the lower sash and drawn down to the window sill, while the window is lowered from the top and the regular shade drawn to cover the open part.

Quill Toothpicks Insulate Shorted Electric Wires

Short circuits of the horn wires in the steering column of an auto, caused by oil destroying the rubber insulation, can be repaired with a quill toothpick when it is not desirable or possible to use friction tape. The toothpick is split its entire length and slipped over the wire where the insulation is broken, after which it is rolled tight and slipped into the hole where the wire comes through, or it may be held firmly about the wire by wrapping a piece of twine around it. This repair will be satisfactory until the wire can be replaced.—Paul Leo, Elizabeth, N. J.



An Inexpensive Scarfpin

A scarfpin that will add to the appearance of your tie can be made from a needle and a common pearl bead. Simply run the eye end of a long needle through the hole in the bead and wedge it in tightly. Fill the top of the hole with a little white soap.

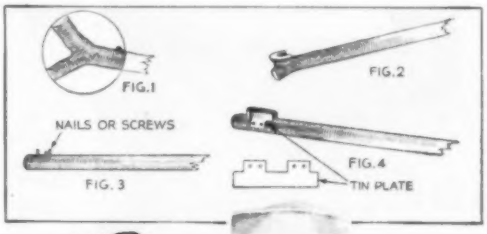
Dart-Throwing *with an* "ATLATL"

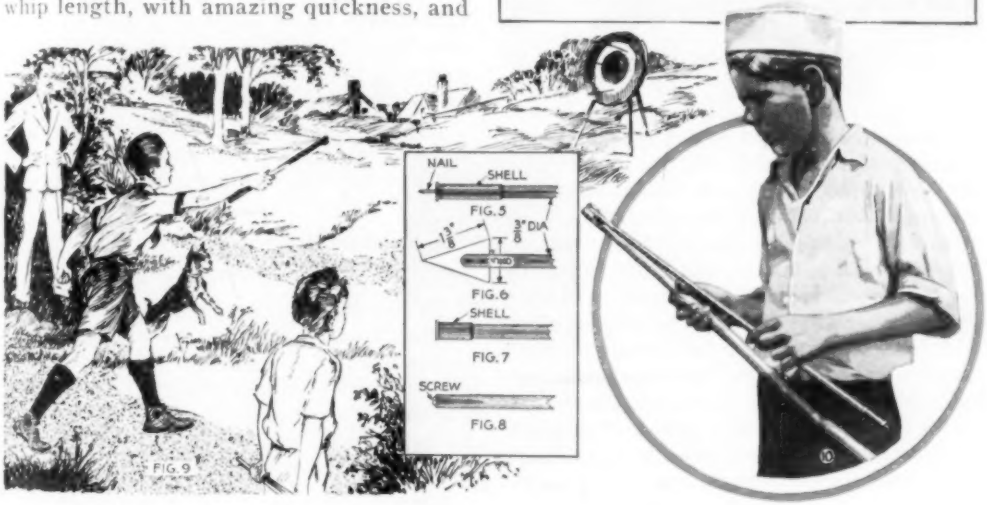
SCATTERED here and there, a hundred years ago, certain Indian tribes used the "atlatl" instead of the bow. Although not as popular as a bow, in the hands of one familiar with its use it was a genuine weapon, sending arrows as far and as accurately. It is an easy matter to make one, and with some practice anyone can send an arrow several hundred feet with surprising accuracy.

The atlatl—pronounced "at-rattle"—consists of a single stick with a notch at one end for the heel of the arrow. In use, you grasp the other end of the arrow between the thumb and forefinger, as in Fig. 11. The whip is then snapped forward quickly, straight over the shoulder, as a pitcher throws a fast, straight ball. The end of the whip describes an arc, equal to that made by the arm plus the whip length, with amazing quickness, and sends the arrow on its course. Get a sapling with a straight length of about 26 in. and a fork at the end as in Fig. 1. The diameter at one end may be 5/8 in. and at the other 1/2 in. The knob formed by the branches at the smaller end should be large enough to permit cutting out a strong notch.

Sharpen the knife point and proceed to make the notch as shown in Fig. 2. This must be slightly broader than the width of an arrow heel and about 3/8 in. long and 3/8 in. deep. Should you prefer another type of notch, you may make one from a small piece of tin cut to the shape indicated in Fig. 4, which is bent and fastened to the end of the whip with small brads. A third type of notch, which is also satisfactory, is made of three small nails or screws, driven into the top side of the whip's small end, as shown in Fig. 3. The heads are cut off after the screws are set, to allow the arrow to slip out easily without catching. The two last-mentioned types will permit the use of a smaller whip, and there is no need for a stick with the enlarged end formed by the fork. Almost any round, straight and springy stick will serve with the tin or nail notches. As a rule, the whip should be at least 4 in. longer than the arrow.

Any straight-grained stick will do for the arrow. If it is of hickory or other tough wood, there will be less risk of breakage. It is not essential that the weight of this arrow is kept down, for you will find, with experience, that heavy shafts can be sent about as far as lighter





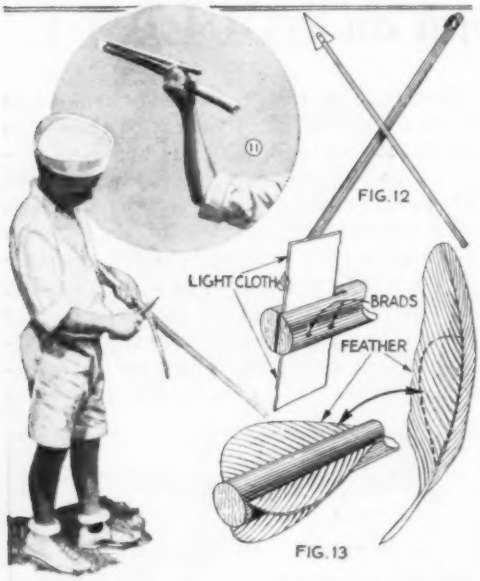


FIG. 13

ones. Saw them out about ⅜ in. square, remove the corners with a plane or sharp knife, then sandpaper down until round or apparently so. Dowel rod can also be used for this purpose. Provide a slight taper between the shaft ends. The larger end should be a tight fit for a 30:30 shell. Cut off the reduced front end, set the shell on a block of soft wood, center a punch over the primer inside and drive it out. If a point is desired, put a six-penny finishing-nail head inside, and drop in some solder. Hold the shell and nail vertically in a flame to melt the solder, then withdraw carefully and let it harden. This not only adds weight to the head, but holds the nail rigid. Now cut off all but ½ in. of the protruding nail and sharpen it. This is an excellent type of head, as it will stick into any wooden target or backstop.

If you wish a blunt head, leave the empty brass shell as it is, as shown in Fig. 7. An empty .38-caliber shell will also do nicely. Another type of blunt head is made by boring a small hole into the arrow head and driving in a round-head screw as shown in Fig. 8. A real hunting arrow head is made by sawing into the head for 1 in. and inserting a thin piece of triangular steel held with two small rivets, as in Fig. 6. No matter how well made the arrow is, it needs a "rudder" at the rear. The best type is made from three feather segments, Fig. 13. To save time, however, you may simply split the end of the arrow and, holding the halves apart with a knife blade, insert a 1 by 2-in. piece of thin cloth. Then put a little glue in the split and withdraw the knife.

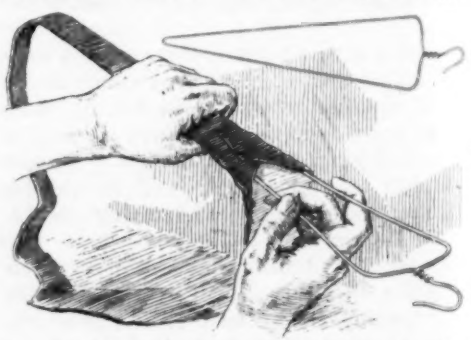
The atlatl is now ready for use. Raise it over and back of the shoulder, just as you would to crack a whip. Brace yourself by placing one foot toward the front, then snap the whip forward, straight over. A side movement will cause the arrow to wabble at first resulting in loss of speed and distance. Continue shooting until you can send the arrow on a straight flight and then practice until you gain accuracy.

Cold-Cream Tissue Polishes Car

Due to its special texture, sheets of absorbent cold-cream tissue have been successfully used for giving a glossy polish to autos after washing. The tissue is folded into a pad and used in the ordinary manner. It removes any excess polish and has been found superior to cheesecloth and other fabrics. As the tissue is used, it crumbles away, and it is therefore only necessary to add new sheets to an old pad for continuous polishing.

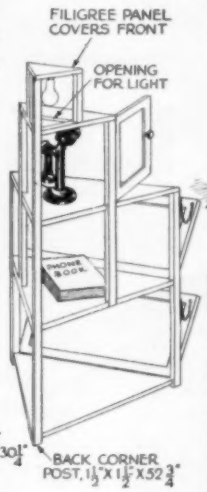
Wrinkles Removed from Neckties with Clothes Hanger

By stretching neckties over a wire clothes hanger, bent to the shape shown, wrinkles can be removed. Insert the wire into the wide end of the tie and slightly dampen the cloth. By having such a holder for each tie, you can keep them neat at all times.—K. F. Keith, Chicago.


Your Neckties Will Always Look Neat If Stretched over These Wire Holders

This Neat Telephone Stand Fits Any Corner

With the exception of a scrollsaw, no special tools are required to make this corner phone stand, the entire job being completed with a hammer, saw and plane. Plywood panels in open filigree are a feature, and the sections are offset, with a light in the top one, the phone in the next below, and the phone catalog and other items in larger compartments below. The panel concealing the phone swings to the left so that the instrument



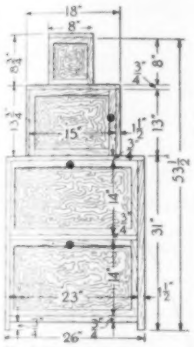
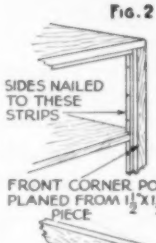
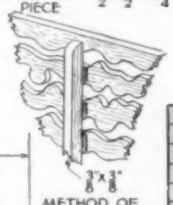


Fig. 1 FRONT VIEW

Fig. 2





METHOD OF BRACING PANEL
Fig. 5

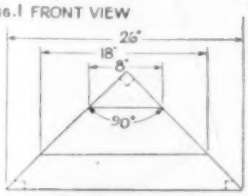


Fig. 6 TOP VIEW

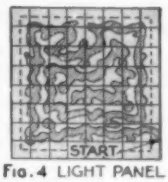


Fig. 4 LIGHT PANEL

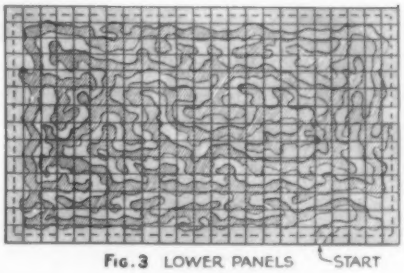


Fig. 3 LOWER PANELS

can be drawn out conveniently with the right hand. The plan, Fig. 6, is simply a right-angled triangle with a 26-in. base, the phone compartment being 18 in. across the front and the light compartment 8 in. wide. Fig. 2 shows a perspective of the framework construction from the rear. The three corner posts are of 1½ by 1½-in. stock. The selection of the wood is a matter of individual taste. Philippine mahogany, maple, birch, and even white pine, are suitable if the job is to be stained. If painted, any kind of easily worked wood, such as poplar, will be satisfactory. Install the tops and shelves, as indicated, allowing for the back panels so that the stand will fit close to the wall. There should be an opening beneath the light to illuminate the phone.

Use ¼-in. plywood for the panels. Intricate as the pattern seems in the squared layouts, Fig. 3, it can be cut out entirely without stopping the saw. Note that the cut in each case begins at the edge and winds around toward the middle, where it starts back again and follows the original cut with a ½-in. space between them. The filigree is then braced with a strip across the back, as in Fig. 5, and installed in the frame, which is to be hinged to the stand. The two lower panels drop forward and are held horizontally by chains.

Glass Push Pins Aid in Painting Board on Both Sides

When it is desired to paint or lacquer a board on both sides, instead of doing one side and allowing it to dry before touching the other, drive in glass push pins at each corner after painting one side. The board can then be turned upside down to rest on the tacks while the other side and edges are painted.—B. L. Gilbert, Chicago.

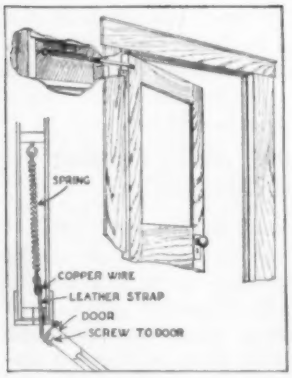
Keeping Toys or Tools in a Wheeled Box Which Rolls under the Bed

Wheeled Storage Box for Toys Rolls under Bed

In homes and apartments where space is limited, this box will be found convenient for keeping toys, as it can be rolled under the bed. It is made of 1-in. stock to any suitable size. Four cart wheels are fastened near the corners, using carriage bolts for axles, so that there will be a clearance of 1 in. between the box and the floor.

This Door Spring Is Out of Sight

Made from a screen-door spring and a piece of rawhide, this door closer is invisible, and especially useful for cabinet doors, although the same idea can be applied to larger doors as shown. The time for installing these closers is when the house is being built or remodeled, as the work necessitates the removal of plaster and lath. One end of the spring is fastened to the wall stud, while the other is attached to the length of rawhide, which is run through a hole cut in the door casing and fastened to the edge of the door. The rawhide prevents noise that would be made by other means of attachment and has long life, needing no oil or attention. —Deane B. Caldwell, Hollywood, Calif.



How Large Drawing Can Be Removed from Drafting Board

In removing large drawings pasted to a drafting board, it often happens that the sheet tears because the paper is stretched too tight. To avoid this, place the drawing board on the floor and set a brick or other suitable support under one side, raising it a couple of inches off the floor. Slit all four corners and also the two ends of the sheet with a razor blade. Pressure applied to the board, causing it to bend down slightly, takes the tension off the paper, so it is easy to remove it by making two more slits on the sides.

Blowtorch Substituted for Gas in Water Heater

In homes where there is no gas supply, a gas-burning water heater can be used to advantage if a blowtorch is installed to provide heat. Remove the gas burner and insert a piece of sheet metal to serve as a flame deflector so that the heat will be more evenly distributed to the coils. Cut a hole in the side of the heater to receive the nozzle of the torch which stands on a shelf bolted to the frame. A large tank of water can be heated with this arrangement in about ten minutes. A 1-qt. torch will burn for about one hour.—Robert J. Bailie, Long Island City, N. Y.

Solution Prevents Rust on Mail Box

Outdoor mail boxes will not rust if coated with a solution made by dissolving enough celluloid in amyl acetate to form a sirup. Apply it with a brush and completely cover the box inside and out.

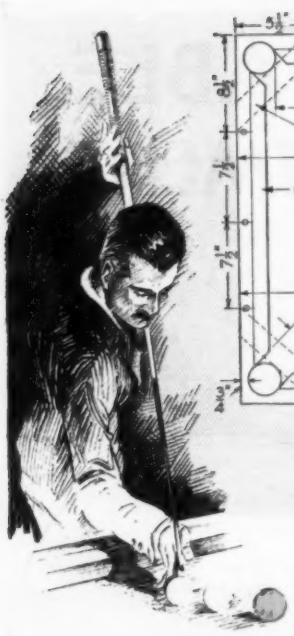
A BILLIARD TABLE *for* HOME *and* APARTMENT

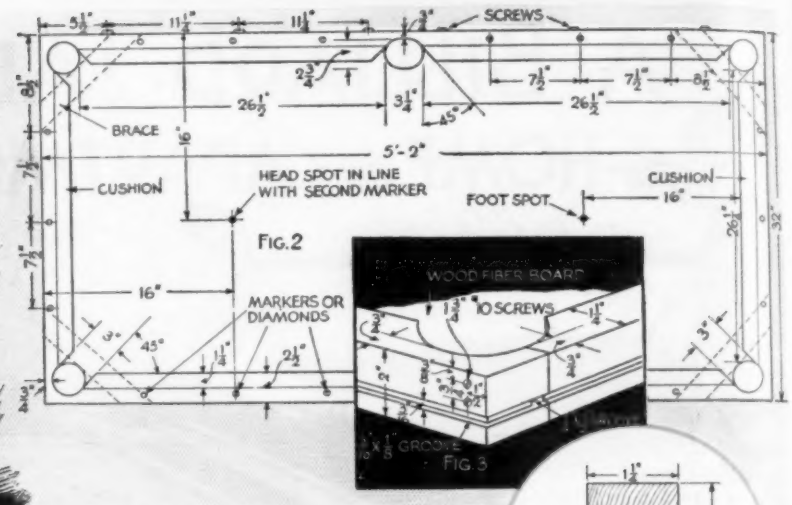
by R. O. Buck

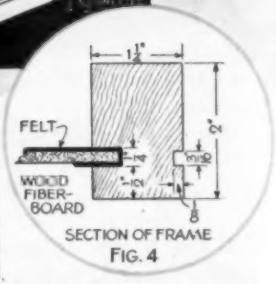
FOR the home or apartment, where space is rather limited, a small billiard table that fits on the dining-room table and may be set in a closet when not in use, can be made in your home workshop.

As the entire frame of the table is covered with an inexpensive grade of imitation leather, it is unnecessary to use lumber that will take a fine finish. The stock for the frame should be sound, well-seasoned material, and the pieces should be planed true. Fig. 2 gives the dimensions of these pieces, and Fig. 4 shows where the grooves for housing the bed are located. Ordinary butt joints are used at the corners and are fastened with two 1¼-in. No. 10 wood screws at each corner. Be sure not to nail or glue the corners at first, as it is necessary to take the frame apart later. A shallow groove is cut around the outside of the frame pieces so that the imitation leather covering can be pressed into it to form a sunken band, which will relieve the plainness of the flat surface. However, this feature is purely ornamental, and may therefore be omitted without affecting the playing qualities of the table. The location and size of this groove and the spacing of the screws are shown in Fig. 3. The bed of the table is made of wood fiberboard or wallboard. The former is preferable, owing to its hard surface and the fact that it is less likely to warp, but the cost is greater. Whether wall or fiberboard is used, it is necessary to do some reinforcing on the underside of the table to give it greater rigidity. Fig. 6 shows the framework of the table assembled with the trusses in place, while Fig. 5 gives the sizes of the latter. They should be screwed into place but not glued as it is necessary to nail them to the bed before the latter is covered with felt.

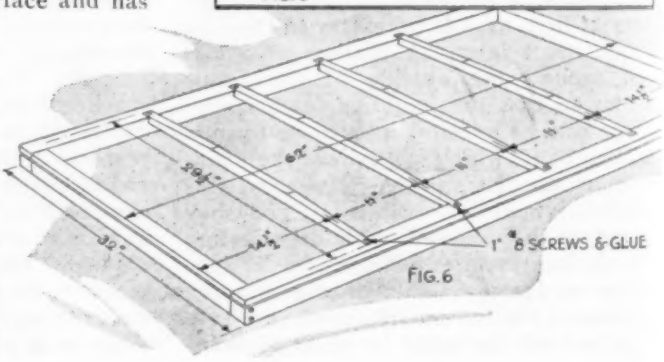
After determining the size of the pockets as given in Fig. 2, make cardboard patterns of these. The corner pockets are round but the center ones are oval. Lay the cardboard pattern on top of the frame and mark around it to establish the line on which the cut for the pocket is to be made. The frame should be taken apart and the opening for the pocket is cut away on a bandsaw, as shown in Fig. 12.







or by means of a coping saw if the former is not available. At this point the bed can be cut to size and the frame and trusses reassembled temporarily so that the pockets can be marked out on the bed. The trusses should be fastened to the underside of the bed by driving small flat-head brads through the bed from the top. This can best be done with the table laid flat on the floor or bench. It will not be necessary to screw the trusses to the frame for this operation if they fit snugly in the mortises. The bed must be removed from the frame by unscrewing one side in order to saw out the pocket holes just marked, and to apply the felt. Fig. 7 shows how the pockets may be cut out with a coping saw. Felt can be obtained in many grades, but it is advisable to get a fairly heavy grade as this provides a good playing surface and has much to do with the accuracy with which the balls can be rolled. A heavy grade is also easier to apply. In doing this, the entire surface of the bed should be covered with liquid glue spread evenly with a brush or the fingers. The felt should be cut a little longer and wider than the bed and should be rolled on a stick. Start the felt on one end of the board as shown in Fig. 8, and gradually unroll, stretching as you go until the entire board is covered. With the palm of the hand, work out all wrinkles and irregularities until a smooth surface results. Felt has considerable stretch and can be worked out with perfect ease, but care must be taken not to stretch it until a thin spot is caused. The excess felt should be turned over the edges and glued down on the underside of the bed. After the entire surface has been made perfectly smooth, and before the glue has dried, the bed should be worked back into the frame



and the latter glued and screwed together permanently. Similarly, glue and screws should be used to fasten the trusses in place. The felt covering for the pockets is cut into triangular tabs which are stretched and glued to the underside of the board, as shown in Fig. 9, thus covering and finishing up the edges of the board where the pocket holes have been sawed out. The leatherette covering for the frame should be applied next. Cut strips of the material 4½ in. wide and as long as the side of the table. If the material isn't long enough to do this, make the joint come at the middle. Start the leatherette just above the groove on the inside face of the frame and stretch it over the top across the face and around under the bottom edge, where it is fastened with tacks. Glue is spread over the entire surface to be covered. At the pockets, the material should be cut away and shaped to fit over the curved edge by fashioning triangular tabs as shown in

FIG. 8

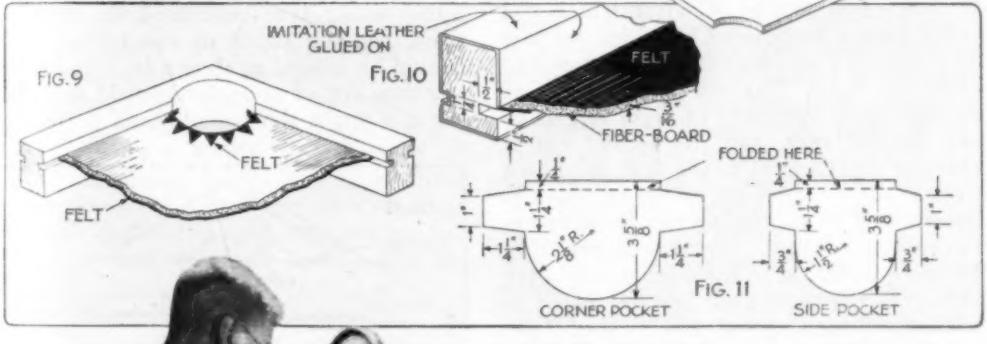
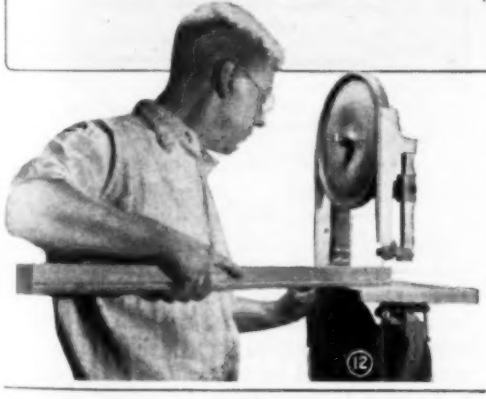


FIG. 11

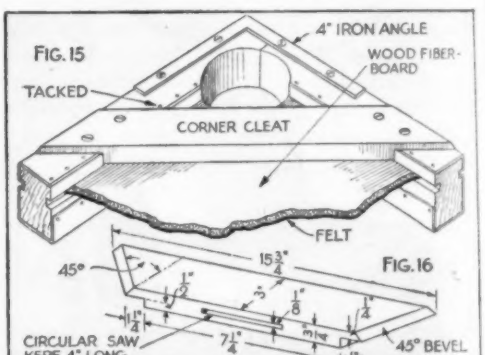


Figs. 13 and 14. While the glue is still fresh, a smooth, blunt instrument, such as the end of a table knife, should be run over the leather along the shallow groove to press the material into it. Fig. 11 gives the dimensions for the pocket trim. These pieces may be made of the same material as the frame covering, or tan-colored Spanish leather can be used if you wish to make the table a bit more attractive. Fig. 20 shows how the pocket trim is fastened at the top with ⅜-in. brass escutcheon pins. The sides of the trim extend under the cushion strips.

In order to give greater rigidity and stiffness to the frame, both an angle iron and diagonal brace are used at each corner as in Fig. 15. The diagonal brace also acts as a support for the pocket rings, a circular saw kerf, shown in Fig. 16, being cut for this purpose. This detail also shows the dimensions of the braces. Fig. 18 shows how the tabs of felt around the pockets can be neatly covered with leath-

FIG. 13

erette to give a finished appearance to the underside of the board. The construction of the cushions against which the balls are caromed, is one of the most important parts of the job. In Fig. 17, details A, B, C and D show the progressive steps in making the cushions. Enough material should be cut exactly 1 by 1¼ in. in size, as shown at A, after which the stock should be beveled on a circular saw as shown in Fig. 21, or it can be planed to shape by hand. The slot for the strip of rubber is cut vertically at right angles to the beveled face, and the second cut is made at right angles to the first, as shown in detail B. The length of the cushions is determined by measuring the distance between the pockets. There will probably be some variation in these lengths so they should be cut to fit, and then numbered to indicate where they go. The ends of these pieces are cut at an angle of 45° as shown in Fig. 2. Sponge rubber, such as can be obtained from an ordinary rubber kneeling pad of rather firm texture, is used for the cushions. Strips ½ by ½ in. in size should be cut from a pad with a razor blade and glued into the groove as shown in detail C. Gummed strips of tough paper, such as is used in stores to seal packages, should be wrapped spirally around the rubber strips to hold them in shape and to make a smooth joint between the rubber and the wood. The final step is to cover the cushions with some of the same kind of felt as was used for covering the bed. The felt will stretch enough so that no seams or folds will show on the exposed surface. Be sure to lap the felt along the back and bottom of the cushions sufficiently so that it will not tear out when the balls strike the rubber. Tacks and glue are used to fasten the felt in place, as shown in Fig. 1. The completed cushions are now fastened in place with 2-in. No. 10 flathead brass wood screws. The screws are driven through the rim into the back of the cushions, three being required for each one. The spacing of the screws is shown in Fig. 2. In order to trim the table and to prevent the screws from tearing and twisting the leatherette, brass screw washers, such as are used on window stops, are placed under the screw heads as indicated in Fig. 22. This also shows the brass corner trim, which is used to dress up the corners, and give the table a finished appearance. Brass upholstering tacks are used for markers along the top edges of the table. They should be spaced as shown in Fig. 2. The markers are of considerable aid in judging the angle the balls should be driven



in making bank shots, so that they will rebound correctly, and therefore the markers should be accurately spaced.

As this billiard table is intended to be set upon a dining-room table, short feet are provided to raise the board just high enough to allow the pockets to drop their full length. Ordinary metal doorstops, fitted with rubber tips, are just right for this purpose, and can be obtained at any

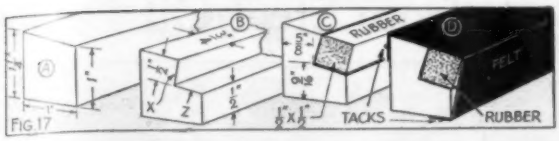


FIG. 17

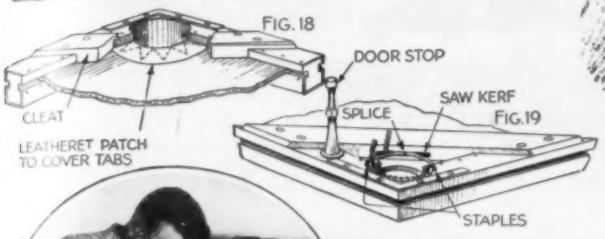


FIG. 18

FIG. 19

FIG. 20

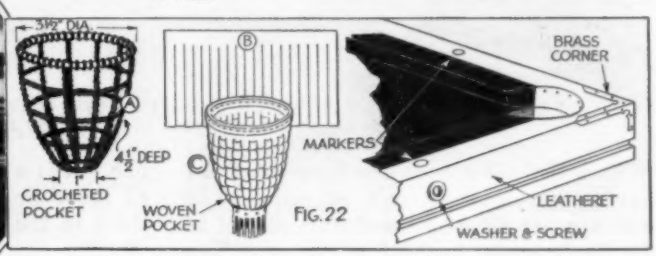


FIG. 22

ten-cent store. Of course, folding legs, similar to those used on card and sewing tables, might be used to advantage but are likely to be less rigid, which greatly affects accuracy in playing. Best of all would be a sturdy table in a spare room in the basement or attic where it could be fastened in place permanently and leveled.

The pockets on most small tables are made of strong twine crocheted into two rings, 3½ and 1 in. in diameter respectively. The rings can be bent up readily from soft wire of about 1/16-in. diameter. The joint is soldered or simply fastened with a ferrule made of gummed paper, as the pocket can be so placed that the joint will come inside of the saw cut on the diagonal brace which supports the outer edge. This is shown in Fig. 19. Small staples are used to fasten the pockets in place. Of course, the pocket is crocheted right on the rings but was omitted from this drawing for the sake of clarity. Fig. 22 gives the sizes and number of rows of crocheted loops required if a fairly heavy and stiff fishing line is used. The larger tables are equipped with leather pockets and you may want to make this type. A piece of soft leather is cut to within ½ in. from the end, as shown in detail B of Fig. 22. The cuts should be ⅜ in. apart. A small disk of wood is used for the bottom to which the leather strips are tacked as shown at C. Strips of leather of the same width are woven in "May-basket" fashion to finish the pocket. The ends of the strips are sewed together and the pocket is then sewed to the ring. The location of the head and foot spots and also the head-spot line or string line is shown in Fig. 2. These are simply spots or lines made on the felt with a soft pencil. They should be about ¼ in. in diameter and must be located exactly as indicated. If a cover is made for the billiard table of the same kind of leatherette as was used to cover the frame, it will keep the table in better shape and protect the felt.

The playing equipment, which must be purchased, consists of one white cue ball, 1 1/16 in. in diameter; 15 colored balls, 1 1/16 in. in diameter; one triangle of the proper size for the balls; two or more maple cues, 42 in. long, and some chalk.

The approximate cost of the playing equipment is about $4.75 and this added to the cost of the material for making the table makes the total cost approximately $12. Although not rigid enough to meet the requirements of the expert player, it provides plenty of entertainment for the average home fan.

Strong Road Culverts from Steel Oil Drums

Discarded Oil Drums with the Ends Removed Were Used by a Tourist-Camp Owner to Make a Culvert over the Grader Ditch between His Camp and the Highway

Discarded oil drums can be utilized for making serviceable road culverts. The ends are cut off and the drums placed in the ditch to be bridged as shown. The removed ends are then bent to the curvature of the sides and laid over the joints to prevent seepage from carrying sand into the culvert, after it has been covered with dirt in the usual way.—Elton Sterrett, Longview, Tex.

Beads Restrung with Catgut

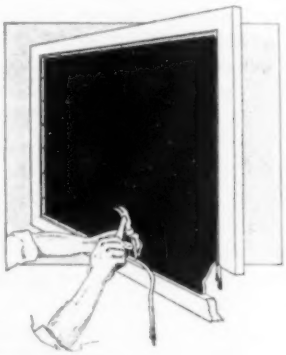
A broken violin E-string of catgut is an excellent substitute for silk thread in restringing beads. It has the advantage of being elastic and will last indefinitely. The gut should be cut diagonally so as to form a joint for easy threading. When finished, wet the end of the gut, tie a knot and cut off the free ends close to the clasp.—K. F. Keith, Chicago.

Skid-Chain Links Made from Nails

Repair links for auto skid chains can be made from sixteen-penny nails, and will probably outlast the life of the chain. They are made by bending the nail to the shape shown, which can be done with two pairs of pliers. The head is cut off, and the link is ready for use. It is a good idea to make a number of these links at your leisure and carry them in the car for emergency use.

Sash Cord Serves as Beading to Hold Blackboard

When making a blackboard for the children, I had not the time or tools to cut a rabbet in the frame to hold the slate in place. As a substitute method, I nailed the frame to the wall, inserted the slate and then tacked a length of sash cord around the inside edge of the frame, as shown, to keep the slate from falling out.—E. Buckley, Philadelphia, Pa.



Photos Removed from Ferrotype Plates by Heat

Photographs that seem dry enough to peel easily from ferrotype tins sometimes stick and will be ruined if force is used. By holding a burning match under the tin at the point where the print sticks, it can easily be peeled off. The tins should be polished with a solution of benzine and paraffin before using them again.

Removing Bag Increased Suction of Vacuum Cleaner

When using a vacuum duster to clean the upholstery of a car, a much more thorough job can be done if the bag is removed, because this reduces the resistance and increases the suction. Drive the car outdoors and work on the windward side so that the dust will be blown out of the car. If there is a puddle of water close to the car, direct the exhausted dust against the water which will absorb most of it.—C. E. Packer, Highland Park, Mich.

How to Produce Colored Flames in the Fireplace

Many metals and their salts impart colors to a flame when burned, and are prepared by mixing the salts with equal parts of powdered charcoal. The powder may be held a few inches above the fire in a teaspoon or it may be sifted into the cracks of the logs before placing them on the fire. Another method is to make a heavy paste by mixing the powders with rosin, wax, gilsonite, or similar substances, and put the paste into small holes drilled in the firewood. This is one of the best methods as the coloring agent is more slowly liberated and the coloring consequently lasts longer. Potassium salts give a lilac tint; calcium salts a brick color; strontium salts, crimson; barium salts, green; copper salts, blue, and zinc salts greenish-blue. Chlorides of certain metals are best adapted for working into the firewood, as they produce the color at comparative low flame temperatures. By using different coloring agents in the same log, beautiful variations can be arranged.

Rack on Inside of Closet Door Keeps Shoes in a Convenient Place

Curtain-Rod Rack on Closet Door for Holding Shoes

This rack, on the inside of a closet door, will keep your shoes where they are easy to get at and off the floor where they may be stepped on. Curtain rods of suitable length are attached to the door and the shoes slipped between them as indicated. An extra rod may be used to hold stockings.

Soap Lubricates Door Latches

To keep the door latches of your car well lubricated, yet prevent them from soiling clothing, wipe off any dirty oil thoroughly and rub white soap on the wearing surfaces. This serves as an excellent lubricant and does not soil the clothes.

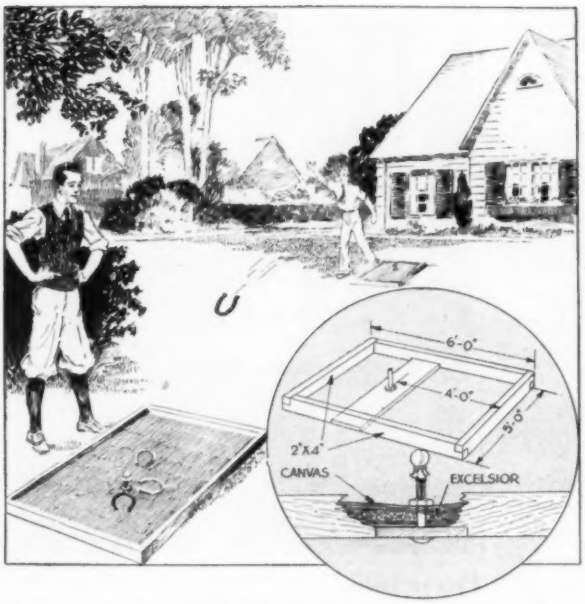
Money for YOUR Ideas

EVERYBODY is an inventor because everybody has at some time or other thought of a time, labor or money-saving short-cut which would help others if they only knew about it.

Such ideas, trivial though they may seem to you, are interesting and helpful to others, and so we are offering three special awards each month for ideas that will help the autoist, the home craftsman and the shop worker.

All ideas used will be paid for at our regular rates and, in addition, there will be three prizes of $25 each for the best ideas submitted.

Send your ideas to the Shop Notes editor, with a small sketch or photograph to make them clear, if necessary.



Horseshoe Can Be Played In or Outdoors without Damaging Floors or Lawns with This Stake Bed

A Portable Stake Bed for Playing Game of Horseshoes

You can play horseshoes almost any place with this portable stake bed, without damaging the floors or lawns. Make a wooden frame of 2 by 4-in. stock, as shown in the detail, and securely fasten a bolt, of suitable length for the stake, in a hole drilled in the center of a 1-in. crosspiece. Nail several layers of burlap or canvas across the bottom of the frame and fill in the space between adjacent pieces with excelsior, rags or even sand, to make a strong mat. It should be well tufted by sewing it with small wire to keep the contents intact.—James Francis Goodman, Stockbridge, Mich.

Loose Valve Tappets Located with Your Fingers

Adjusting nuts on valve tappets sometimes loosen and cause a clicking noise which is difficult to locate. The tappet causing the trouble can usually be detected by feeling each one in turn with the forefinger, being careful not to get the end of the finger between the end of the tappet and the valve stem. The actual click of the tappet should synchronize with its movement as felt by the finger. The amount of clearance of extremely loose tappets can be determined by feeling the actual closing of the gap between the end of the valve stem and the tappet. To be positive that you have located the right one, wedge the end of a screwdriver between the valve spring and the adjusting screw, which should completely eliminate the noise.

Mosquitoes Controlled by Extract of Pyrethrum

A new form of "ammunition" for fighting mosquitoes has been developed by the New Jersey agricultural experiment station. It is a kerosene extract of pyrethrum, emulsified with soap and water. One gallon of the mixture should be diluted with 10 to 15 gal. of water before using it. It can be safely applied to waters where mosquitoes breed without danger to fowls or water flowers. Unlike oil, it does not discolor the water, and can be used on golf courses and similar places without killing the grass.

Cooking Pans Can Be Tilted with Angle-Iron Wedge

Fitted with a handle, an ordinary piece of angle iron makes a handy kitchen utensil for tilting pans on the stove, especially when it is necessary to drain cooked foods. A 15-in. length of ¾-in. angle iron will be most satisfactory for this purpose, and a wooden handle can be purchased at any hardware store. The latter is riveted to the iron at a slight angle, as shown.—C. B. Barr, Stratford, Connecticut.

Cooking Utensils Can Be Tipped and Held in Position with This Angle-Iron Tilter

Beautiful Lamp Bases from Glazed Tile

By EDWIN M. LOVE

SPANISH tiles of neat design are readily obtainable, and together with plain tiles in various colors, narrow border strips, quarter-rounds and returns, can be combined to form highly attractive lamp bases.

For a square base of the kind shown in Fig. 4, a wooden core is needed. This is made from four pieces of 1-in. pine, cut 3¼ by 8½ in., and nailed together to form a column, as in the detail below Fig. 2. Nail a 1-in. bulkhead 1¼ in. from the upper end, and bore a 1-in. hole through the center to allow the passage of electric wires. Stud the outside of the column with shingle nails, leaving the heads projecting ¼ in. as anchors for the mortar used to hold the tiles. Four 6-in. tiles are mitered together for the base. If possible, get these all alike or else choose harmonizing designs and colors. To miter the joining edges, clamp the tiles in a vise and chip off the edges with a cold chisel, starting close to the back corners to avoid breaking them. When the "feel" of the material is obtained, fairly large chips can be knocked off. Smooth the rough spots and work up close to the glazed surface by grinding on an emery wheel, as in Fig. 8. Before cementing, soak the tiles in water until bubbles no longer appear, as otherwise they will dry out the mortar and pull loose. For the same reason wet the wooden core. This will also minimize swelling of the wood and help prevent cracks in the plastered top. Tack a short board over the top of the core and wooden blocks, 2½ in. wide, around the column and on the board. Invert this assembly as in Fig. 1, plaster the nails, coat the tiles with mortar, and stand them against the core, resting them on the 2½-in. blocks. As the tiles are slightly irregular, exact squareness will be impossible, but they should be brought nearly true with a try-square. Bind them together with a stout cord, leaving the corner joints open 3/16 in. This clearance, as well as the proper distance from the core, can be maintained by driving wooden wedges where opening-up is necessary. Fill open spaces between the tiles and the core with thin cement poured from a can, as in Fig. 3. Then build up a base of mortar, ¾ in. thick, mixing the cement stiff enough to allow it to be easily molded. Keep it back from the face of the tiles ¼ in. and model it quarter-round. To provide space for the wires, plaster in a paper tube. Lay a wet cloth over the base, so that it will remain moist while setting.

The standard above the base is made of four quarter-round pieces, 6 in. long, assembled in a cylinder with strips of ½ by ½-in. border tiles, sandwiched between

⑥

them. Set a paper tube in the center, fill around it with mortar and press the flat strips in so that they are 1/16 in. behind the quarter-rounds. When the base has hardened sufficiently to bear weight, remove the four blocks and the false base, and set the standard on the bulkhead in the core. Center it, and fill around with fairly stiff mortar. If the core is dry, wet it, and build up, allowing about ¼ in. for final plastering. Build up a ½-in. layer on top of the core around the standard and scrape the modeled part fairly true with the corner of a wooden block, as shown in Fig. 2. Patching plaster is used for finishing. Mix it dry with sufficient pigment to give the light-blue tone of the tiles. Then mix with water and apply. After it has set for several hours, the surface can be finished by scraping with a wooden block. The bottom of the base is finished in the same way.

A double-socket fixture, about 6½ in. high, is good for this base. As the flange cannot be screwed or bolted to the tile, it is necessary to fasten the fixture with a copper wire doubled and passed through from top to bottom. Fix a six-penny nail in the loop, and pull the wire ends out at the top of the fixture until stopped by the nail against the underside of the core bulkhead. Twist the ends of the wire over a shingle nail laid crosswise in the fixture, between the socket outlets, until the wires are fairly tight, and cut off the ends. Then drive short wooden wedges under the flange until the fixture is held rigidly. Fill the space between the flange and the standard with plaster. Now thread the wire through the base and one socket top, and split the silk covering for 2½ in., allowing the two wires to separate. Then tie the knot pictured in Fig. 5, which also shows dimensions of the lamp. This knot prevents the wire from being drawn from the socket cap and relieves the binding screws from strain. Then connect the wire to one socket and run short leads to the other. The wire frame for the shade is

⑦

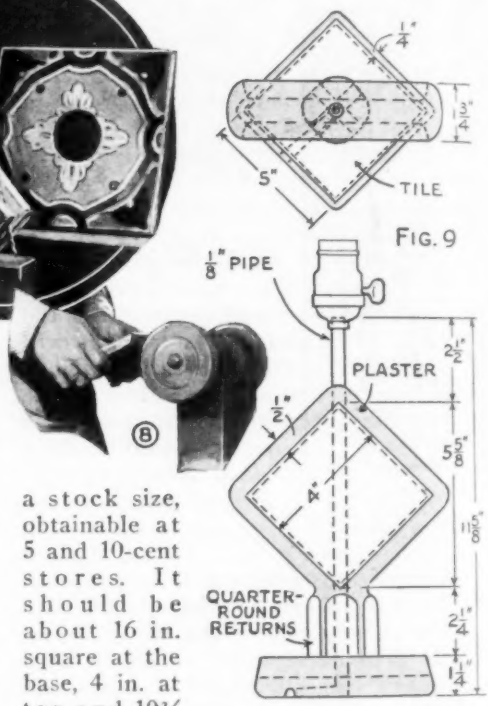


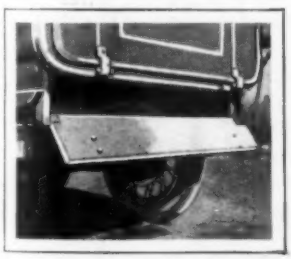
FIG. 9

a stock size, obtainable at 5 and 10-cent stores. It should be about 16 in. square at the base, 4 in. at top and 10¾ in. high, or corresponding proportions.

Fig. 6 illustrates a smaller design. Select two 4-in. square tiles, and plaster them together to make an outside thickness of 1¾ in., having a paper tube inserted diagonally to leave room for a pipe or tube to take the wires. Tie these together with twine until the cement sets, as in Fig. 7, remove the twine, and add a ¼-in. layer of cement to the edges. While this is setting, drill a 1-in. hole in the center of a 5-in. square tile. Begin by chipping the glaze at the center with the corner of a narrow cold chisel, and gradually widen out to the desired diameter. If the tile is cupped downward, rest it on a 2-in. square block, to lessen the chance of

breaking it. When a rough hole has been chipped to size, put the tile to soak while the pipe is being cemented into the body tiles. Clamp this assembly in a vise, and build up the short column as shown. This column is made of four pieces of black quarter-round returns, cut to a length of 2¼ in. Chip the glaze with a cold chisel, tapping lightly, and then break off with heavier blows. Grind the bases even. Bind the pieces together with 5/16-in. strips of wood in the joints, slip them over the pipe and support them on a couple of wooden blocks at the proper distance from the body tiles. Fill the interior with cement, adding several nails above to extend to the height of the pipe. After setting up, put the base in place and build up a layer of cement on its underside, ¼ in. thick, leaving a groove for the wire, and laying several nails crosswise for additional reinforcement. Mix dry burnt umber with cement in equal parts for plastering the body-tile edges, the base and filling the joints of the column tiles. A hexagonal shade, measuring about 7½ in. high, 4 in. across the top and 9 in. at the bottom, is suitable for this base. If cracks appear in the cement after a few days, peck the exposed parts with a nail point and give a thin coat of plaster, not neglecting to wet the old plaster before applying the new.

Toolbox Built under Truck Body



Built between the frame members at the rear and underneath the body, a wood or metal box on the truck will keep your tools accessible at all times. The box should be fitted with a hinged door, and if provided with a good lock, will be theft-proof. To avoid constant rattling of the tools, pad the box by placing a heavy piece of cloth, doubled, on the bottom, and stuff some rags over the tools.

¶To drive nails into plaster without breaking or chipping it, first heat them.

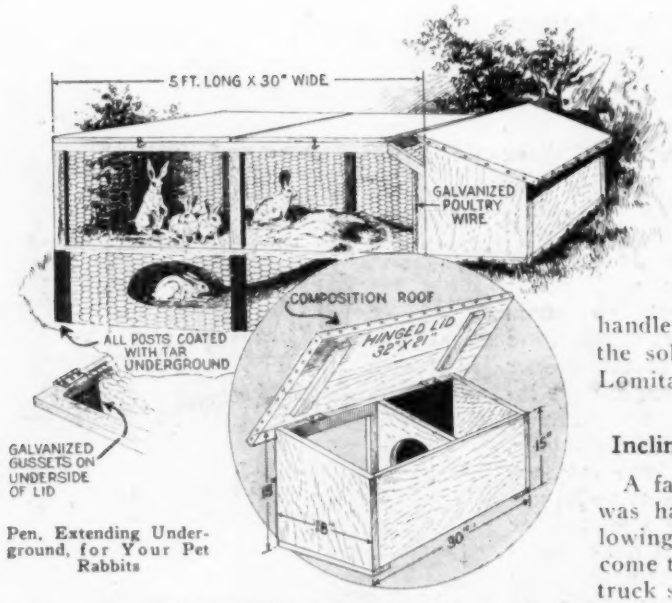
Equipped with Casters, This Stepladder Can Be Moved About without Getting Off

Wheeled Stepladder Saves Time

When painting or cleaning ceilings, a wheeled stepladder will save much time in shifting it about. Large casters are the most practical for this purpose and can be purchased with braces for attaching them to the ladder legs. They are easily removed when it is desired to have the ladder stationary.

Window Fastener Holds Drop Lid of Typewriter Desk

Attached to the typewriter desk as shown, an ordinary window-sash fastener will hold the lid securely. The movable latch is attached to the side of the desk, where it is easily accessible, while the catch is fastened to the drop lid. The wedging action of this device holds the typewriter rigid.

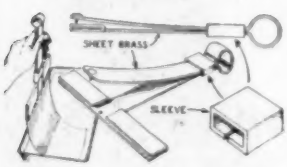


Pen, Extending Underground, for Your Pet Rabbits

Your Pet Rabbits Will Be Contented in This Pen

Pet rabbits are more contented if allowed to burrow, and this pen, which is set 1 ft. into the ground, will allow them to do so without letting them escape. The pen is 5 ft. long and 30 in. wide and will house four or five rabbits comfortably, but can be built larger if desired. The frame, which is strengthened at the corners with galvanized gussets, is covered on three sides and the bottom with 1-in.-mesh galvanized poultry wire. Two lids are provided, being merely frames covered with the wire and hinged to the pen. When completed, the part of the frame that is to be underground is covered with tar to prevent it from decaying. Then a trench, about 1 ft. deep, is dug and the pen set in it. The house at one end of the pen is fitted with a nesting compartment and a hinged lid.

Clip Holds Films While Developing



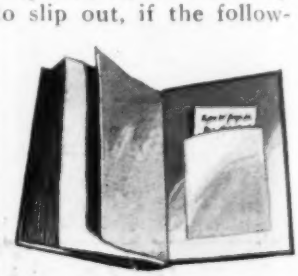
This clip is a great aid for holding negatives while developing them. It is made of light spring sheet brass, cut and bent to the shape shown. The point of a brass pin is soldered to one end, while a hole is drilled in the other to take the pin when the clip is closed, a brass sleeve being used for this purpose. The clip is fastened to the negative while it is dry, and is not removed until it has been developed and dried, serving as a handle to keep the fingers out of the solutions.—Harold I. Calkins, Lomita, Calif.

Incline Aids in Starting Truck

A farmer, who had a truck that was hard to start, found the following method effective to overcome the trouble. The floor of the truck shed was raised by filling in dirt until it was high at the back and formed a fairly steep incline. When the truck was stored at night, it was backed into the shed and the brakes set. It was then a simple matter to start it by putting it in gear and releasing the clutch and brakes. After the truck had coasted down the incline, the clutch was engaged and the truck immediately started.

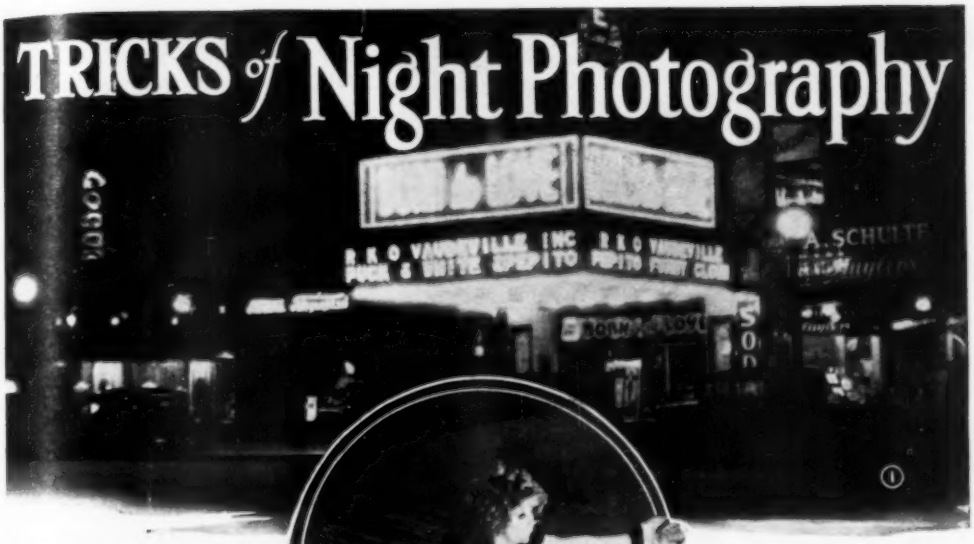
Memo Envelope Fastened to Cover

Memos that are written on small sheets of paper can be kept in a book where they are not likely to slip out, if the following method of holding them is used: Cut one end from an ordinary envelope and paste it on the inside of the cover, with the opening toward the back or top. Place the memos inside of this improvised pocket, and they will be there when you look for them the next time.—C. Edward Packer, Highland Park, Mich.



¶A set of two blueprints, SN-7 and SN-8, on "Aero-Boat" can be obtained for 50 cents and a material list will be sent free

TRICKS of Night Photography



WITH the use of the films and plates now on the market night photography is a new and thrilling field, heretofore little exploited by the amateur. It is possible to make successful snapshots inside of theaters, along city streets at night, and wherever else there is artificial light of good intensity, without the need of expensive equipment.

Amateur cameras are available with lenses operating at a speed of f:4.5, and these will do nicely for night photography. It is possible to make night pictures with slower lenses when light conditions are particularly favorable, and when movement is not great. As most artificial light is rich in red and yellow rays, it is necessary to use panchromatic films or plates. Cut film, plates and motion-picture film of this sort are sensitive to all colors of the spectrum, whereas ordinary emulsions depend on violet and blue light for most of their speed. A supersensitive panchromatic film, several times as fast as that formerly provided, is available in cut-film form and in motion-picture film. Plates also are procurable. To make theater pictures, load your camera with this

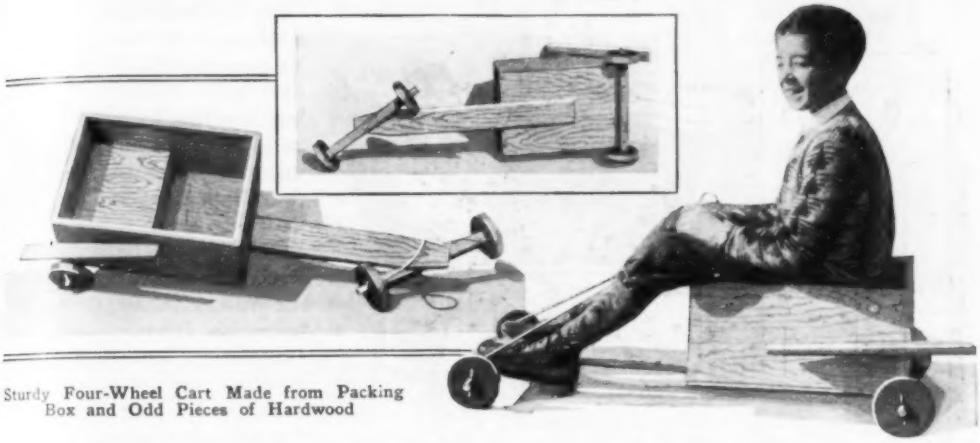
With the Use of the Fast Films and Plates Now on the Market Night Photography Is a New and Thrilling Field, Heretofore Little Exploited by the Amateur

supersensitive film, set the lens at its widest opening, adjust the shutter to 1/25 or 1/50 second, and make the exposure when the light is at its maximum intensity. There are periods when actors are practically motionless and when the spot light and all stage lights are on. Sometimes you can shoot at 1/10 second and get away with it. One of the best places from which to photograph stage scenes is a box on the first-balcony level. Outdoors, beneath theater canopies, in amusement parks and wherever else the light is fair, you can obtain interesting snapshots. Shutter speed should be as low as practicable, because it is better to overexpose than to underexpose. Where there are people moving about, as in streets, always place yourself so that your subjects are moving either toward or away from the camera to minimize movement. Such a shot is shown in Fig. 5, where the exposure was 1/10 second at f:4.5 lens stop.

Sometimes even the supersensitive panchromatic films obtainable at photographic dealers are not as speedy as they might be. By a simple chemical trick, you can step up the sensitivity as much as two or three times in the following way: Mix one part of 28-per-cent ammonia solution in 25 parts of water, preferably distilled. Bathe the panchromatic film or plate in this for about 45 seconds. Then place the film, without rinsing it, in the draft of an electric fan. The quicker the sensitive emulsion is dried, the better. Film thus treated has still greater speed, but will retain this, in normal temperature, for only a few days, and should therefore be used at once. However, it can be stored, if necessary, in a refrigerator where it will retain its vigor longer. Of course, all of the hypersensitizing operations must be carried on in absolute darkness. Likewise, developing is done in the dark, without the aid of even a special green panchromatic safe light, until development is almost complete. Films and plates hypersensitized with ammonia are useful for purposes other than night snapshots. In making flashlight or flashbulb pictures of some objects where the illumination at best is only fair, such as a large crowd of people or a building, you will find this "pepped-up" film of great value. A window display can also be photographed.

The photos shown here were made according to the methods just described. Fig. 1 was made with a reflecting camera, using ammonia-treated film and making the exposure at 1/25 second at f:2.5. Figs. 2 and 3 were made with supersensitive panchromatic film, 1/25 second at f:4.5, the film being untreated. Fig. 4 was taken at 1/25 second at f:2.5 lens stop, while Fig. 6 was taken 1/10 second at f:4.5. In both cases the film was ammonia-treated.

Father Made His Carts from Packing Boxes

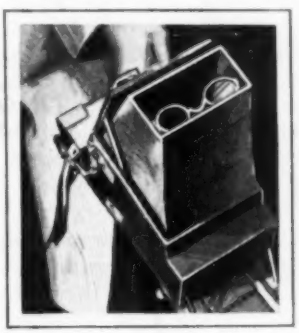


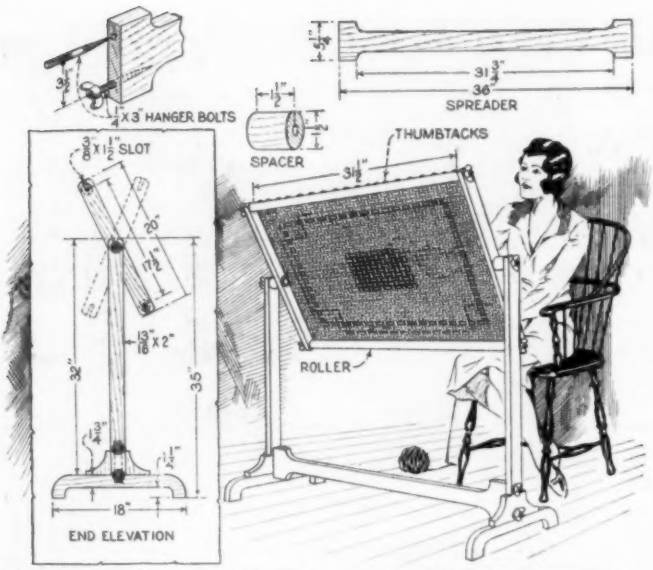
Sturdy Four-Wheel Cart Made from Packing Box and Odd Pieces of Hardwood

No boy need be without a cart, for the kind father used to make cost only a few cents, and perhaps you can build one for nothing. Ask your grocer for two strong wooden boxes, one about 2 ft. long and 18 in. wide, and the other almost any size, as it is to be knocked apart and the pieces used. When you knock the sides off, don't use a hammer on the wood directly, but take a stout stick, hold it against the side and then tap on the stick. This will prevent splitting up the wood. The unbroken box is nailed to a 3 or 4-ft. board, using a sufficient number of nails to prevent it from coming off. These should be driven down through the box and board and clinched on the other side. The axles are made from 2 by 24-in. pieces of hardwood, such as oak or maple, the latter being preferable. The ends of the axles are rounded for 1½ in. and the diameter of the rounded portions should be ¾ in., leaving a sharp shoulder on the square part. This should be done on a lathe for accurate results, and while at the lathe, the wheels can be turned down, hardwood also being advisable for this purpose. They should be about 5 in. in diameter, and ¾-in. holes are bored exactly in the center. Drill a hole through the center of the front axle and another through the end of the board for a ¼-in. bolt. Then attach it, slipping a large washer between the board and axle. The rear axle is bolted to the bottom of the box. The wheels are then attached and small holes are drilled through the ends for cotter pins to keep the wheels on, washers being used between the wheels and pins. A little cup grease should be applied to the axles to make the cart run smoothly. If you can't get someone to turn down the wheels on a lathe, use a fretsaw and cut them down to the right size, scribing a circle of 5-in. radius and sawing straight across the wood on the line. A length of rope is tied to the ends of the front axle near the wheels, and a wooden brake lever is pivoted to the box so that it can be pushed against one of the rear wheels. A seat inside will also be handy.—C. H. Adler, Corona, L. I.

Mounting Spectacles on Camera

A cameraman in Montreal, Can., has solved the problem of hunting for his spectacles when focusing his camera for a quick "shot." He attaches them to the sides of the focusing hood on his Graflex as shown in the photo. This method has made it possible to obtain many good pictures that had to be taken on the "spur of the moment," and would otherwise have been lost.





Hooked Rugs Can Be Quickly Made with This Adjustable Frame Which Holds the Burlap Foundation Taut without Lacing

An Adjustable Frame for Making Hooked Rugs

Anyone who has had experience in making hooked or punched rugs will appreciate the advantages of this type of frame for supporting the burlap foundation and keeping it taut when working with an automatic rug needle. The uprights and arms, shown in the left-hand detail, are 2 in. wide and are made from birch or maple stock. The feet are cut to shape and screwed to the bottom of the uprights and the joints strengthened with triangular braces, also screwed to the feet. A spreader bar is cut to the shape indicated in the upper right-hand detail and fastened between the uprights by means of hanger bolts, one end being driven into the bar and the other fitted with a washer and wingnut. A ¼-in. hole is drilled in the center of each arm for carriage bolts, 3½ in. long, also fitted with washers and wingnuts and held in slots sawed in the end of the uprights. A 1½-in. spacer is put over each bolt, between the arm and the upright. Center the ends of two pieces of 1⅜-in. round stock, 31½ in. long, fit them with a hanger bolt in each end and place them in slots cut in the ends of the arms. Fasten one end of the burlap to one of the rollers with thumbtacks, and the other end to the opposite roller in the same way, driving thumbtacks in tight and not over 1 in. apart. Give the first roller one turn and lock it securely by tightening the wingnuts at each end. Roll up the burlap on the opposite roller and draw it tight by twisting the roller at the ends, then lock the wingnuts, and you are ready for work. When the portion of the burlap foundation between the rollers has been worked, turn the frame over and clip the burlap. Roll up the finished portion on the first roller and tighten it. Turn the frame over and finish the work. By loosening the wingnuts on the rollers and the top of the uprights, and running off those on the spreader bar, the frame can be taken down in a few seconds for storing.

A Self-Measuring Container

This container will be useful for measuring coffee, sugar, and the like, where the same amount is used each time. Take a sheet-metal tube and flare one end to a funnel shape or solder part of a funnel to the tube. Then insert it through a hole drilled in the lid of any suitable container so that the tube is a snug fit. As only the contents between the bottom of the tube and the bottom of the container will come out when it is turned upside down, adjust the tube up and down until the de-

Equal Amounts of Coffee, Sugar, Etc., Are Automatically Measured with This Container

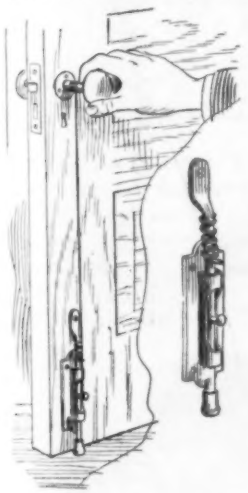
sired amount comes out. Then solder the tube to the lid. The container should be shaken each time.

Uses for Model-T Ford Parts

Old valves from a Model-T Ford motor can be made into large-head bolts by cutting threads at one end, where a small hole already is provided for a cotter key. Also, the bottom bowl of the carburetor can be removed and soldered onto a tube to make a funnel. Old cylinder-head gaskets, when split, make good shim material.

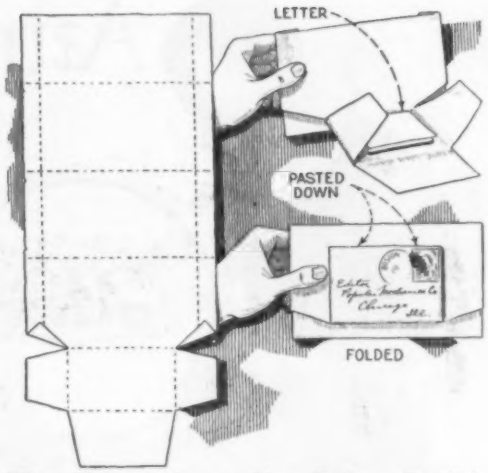
Doorstop Worked by Turning Knob

An ordinary door bolt will make a stop that automatically holds the door in any position. It is screwed to the bottom of the door, the lower end being covered with a rubber tip. A length of twine is tied to the handle of the bolt and around the shank of the knob, then securely wrapped with friction tape to prevent slipping, so that the bolt will be raised when the knob is turned. When released, the bolt is pushed firmly against the floor by a compression spring which is held in place by means of a pin in the end of the bolt and a short rod, flattened at one end and screwed to the door as shown.



Gasoline Stove Used without Pump

The next time you go camping and forget the pump for your stove, or break it, try this trick. Pour the tank about half full of gasoline and submerge it almost to the top in cold water, leaving the filler cap open. After the tank has cooled, screw the cap tight and set it in the hot sun for a few minutes but not near flames. The cold air will expand and produce pressure enough to cook a meal.



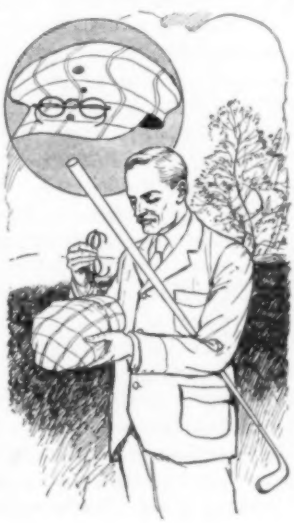
When Mailing a Letter with a Package, Try This Method of Wrapping Both under One Cover

Improvised Folder Covers Both Package and Letter

An inexpensive folder for mailing first and fourth-class matter in the same wrapper is shown in the drawing. Wrap the package in the usual way up to the last fold and then cut the flap so that it can be turned over the letter, gluing or pasting the edges down securely. This method is especially useful when no envelopes are at hand.

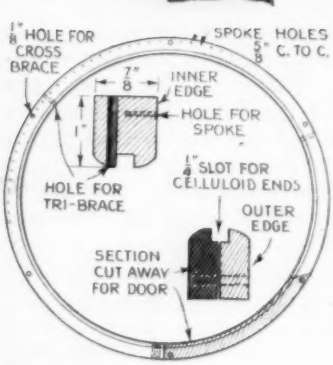
Cap-Visor Snap Holds Spectacles

Fishermen, sportsmen and others will find that their spectacles can be safely held behind the snap on their cap visor if the snap holds firmly and the space behind the spectacles will not allow the wider parts to slip past. Loose-fitting snaps can usually be cured by tapping the button lightly with a hammer.—Ashley Smith, Chicago, Ill.



Attractive Homes

By Robert Gregg



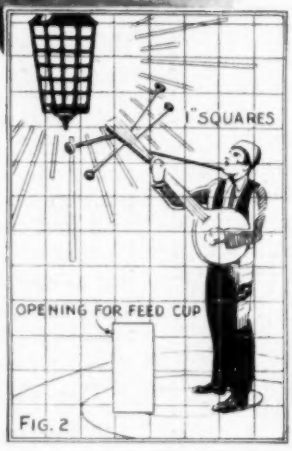
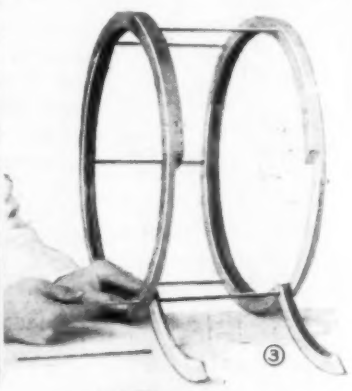


FIG. 2

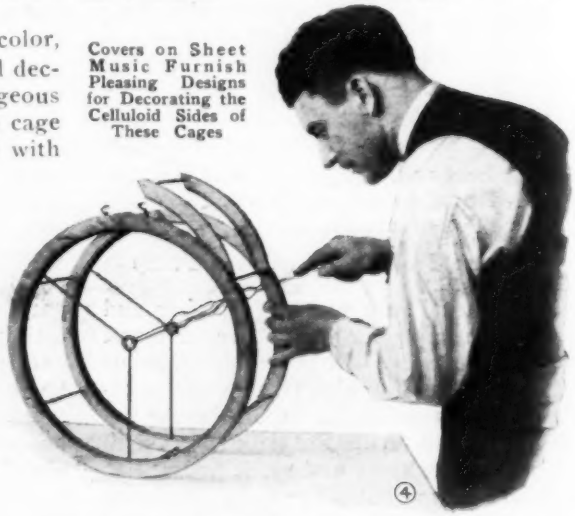
be trimmed down to 7/8 in. in thickness and 1 in. in width across the face, as shown in the detail below Fig. 1. The spoke and assembly holes are drilled, a slot is cut on the inside of each rim for the celluloid endpieces, and a portion of the rim is cut away to form a door for the prospective cage. The easiest way to cut the door section is to drop the rim over a circular saw, as in Fig. 1, and then finish the cut



WITH blithe song and flash of color, birds are both entertaining and decorative. But no matter how gorgeous the bird or how sweet his song, the cage comes first, and it must harmonize with both the songster and the room. For small birds, a regular canary cage is usually suitable. Finches require larger cages with the bars quite close together, and nightingales need broader, lower cages, while parrots call for more spacious ones.

The circular cage shown in Fig. 6 offers a variation from the more or less stereotyped forms. The construction has a humble beginning—two wooden steering-wheel rims picked up at an auto-wrecking yard. Each rim should

Covers on Sheet Music Furnish Pleasing Designs for Decorating the Celluloid Sides of These Cages



Two Wooden Auto Steering Wheels Make a Sturdy Frame on Which the Wire Bars Can Be Quickly Assembled

for Your Birds

square with hand tools. The initial assembly is shown in Fig. 3. Ordinary bicycle spokes are used to hold the two rims together, threading the spokes through 7-in. lengths of copper tubing and fastening them with the spoke nipples. Four spokes, cut to the proper length and riveted to a metal disk or ring, furnish a three-legged brace across each ring, as in Fig. 4, to form a support for the perch and for the feed cup. The exact shape of the wires that hold the cups can be determined by purchasing two cups and fashioning the spokes to fit. The nipples should be slightly countersunk so that the holes may be filled with putty and finished flush.

With the framework made, it is a simple matter to cut No. 6 gauge piano wire to bicycle-spoke lengths, and set these in place, as shown in Fig. 8. The spring of the wire will keep them firmly in position. The center part of the topmost spoke is bent to a V-shape to permit centering the supporting point. The celluloid ends come next. These are made of clear celluloid, cutting them slightly oversize so that the disk will snap into position. Each circle is properly cut so that the feed cups can be fitted in place. The exact position and size of this opening are given in Fig. 2. This detail also suggests a suitable sketch which, when done in transparent oils, adds beauty to

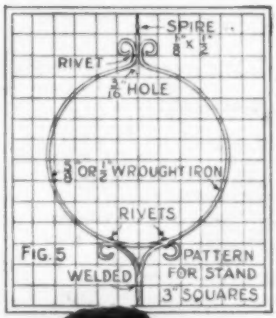


FIG. 5

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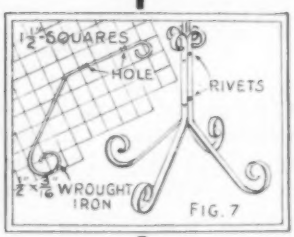

FIG. 7

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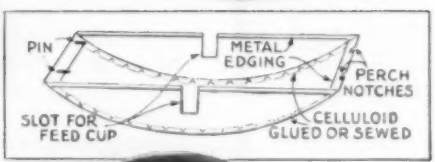
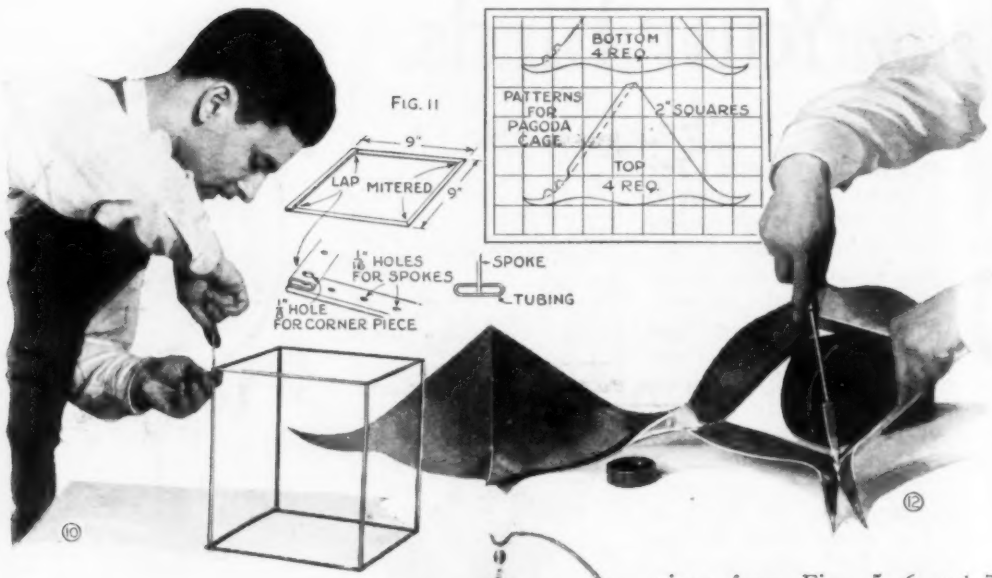
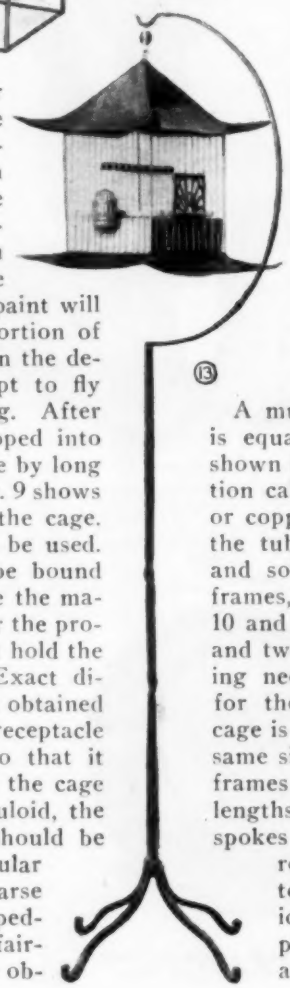
⑨



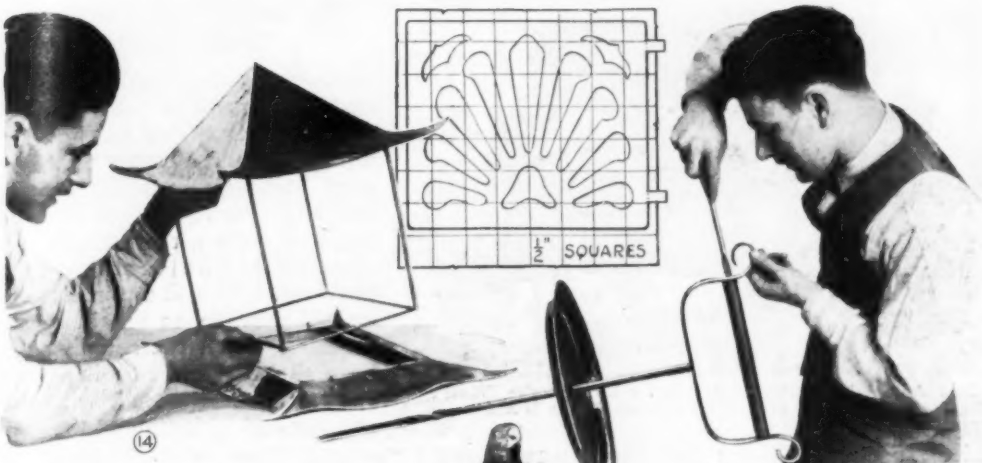
A Celluloid or Sheet-Metal Tray, Conforming to the Curvature of the Cage and Fitted with Perches, Is Slipped into Place



the finished cage. The cover designs on sheet music are especially adapted to this purpose. Direct tracing through the clear celluloid makes the art work very simple. The surface should be washed with household ammonia to remove finger marks over which the paint will not take. No considerable portion of clear celluloid should be left in the design, as a bird would attempt to fly through this apparent opening. After the two ends have been snapped into position, they are held in place by long strips of rattan, cut to fit. Fig. 9 shows how the pan is fitted inside the cage. Either celluloid or metal can be used. If celluloid, all edges must be bound by metal in order to reinforce the material and to furnish a base for the projecting pins and the slots that hold the feeding perches in place. Exact dimensions for the pan are best obtained direct from the work. The receptacle should be shallow enough so that it can easily be slipped through the cage door. Whether metal or celluloid, the curved bottom of the pan should be covered with a sheet of regular bird gravel paper or with coarse sandpaper. The making of a pedestal stand for this cage is a fairly simple matter, and is quite obvious from Figs. 5, 6 and 7. The whole unit is built up from ½-in. wrought-iron stock, riveting and welding the pieces together. To eliminate the difficult weld on the tri-legs, a four-legged base of flat stock, shown in Fig. 7, can be substituted. In either case, an all-black finish is highly attractive, especially if the wooden rims of the cage are done in contrasting reds or greens.



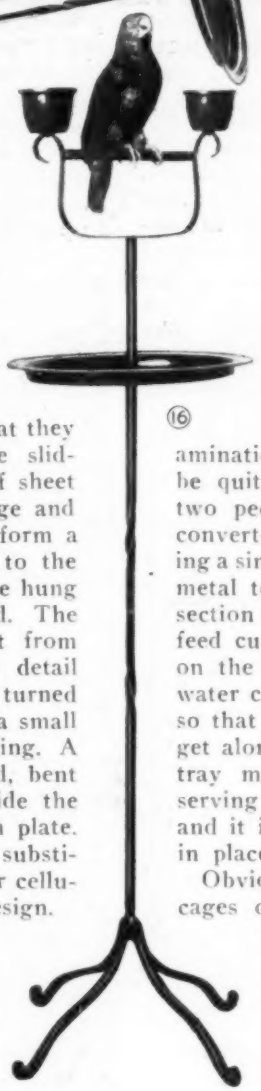
A much simpler cage, but one that is equally novel, is the pagoda cage shown in Figs. 10 to 14. This construction calls for bicycle spokes and brass or copper tubing. Suitable lengths of the tubing are hammered almost flat and soldered together to form two frames, 9 in. square, as shown in Figs. 10 and 11. The bottom has two miter and two lap joints, the lapped end being necessary to provide an opening for the sliding tray with which the cage is fitted. The top frame, made the same size, is mitered all around. Both frames are fastened together with 9-in. lengths of copper tubing, using bicycle spokes and nipples in the manner already described. The top and bottom of the pagoda cage are fashioned from sheet copper, either plain or hammered, and soldered at the corners as shown in Fig. 12.



⑭ ⑮

While the top of the cage may be soldered to the framework, the bottom should be made removable. This is done by soldering four small screw heads to the base piece, and fitting the tube framework with corresponding slots to lock. Lengths of No. 6 gauge piano wire are snapped into the holes cut through one side of the tube framework. Suitable openings, of course, must be provided for the feed cups so that they can be readily detached. The sliding tray is simply a flat strip of sheet copper, curled on the outer edge and slightly crimped all around to form a shallow pan. An eye is fitted to the top of the cage so that it may be hung in a simple wrought-iron stand. The door for the cage can be cut from sheet metal according to the detail above Fig. 14. The tabs are turned over to form the hinges, while a small spring makes the door self-locking. A strip of amber-colored celluloid, bent to shape and neatly fitted inside the cage, makes an excellent splash plate. Fine copper screening can be substituted for this if desired, or clear celluloid with a colorful, stenciled design.

In both cages, the perches are made from 7/16-in. dowel stock, tapered down slightly from center to ends. For the average small bird, it is unwise to make the perches smaller than this, as ungraceful claws and rheumatism are sure to result. For larger birds, an increased diameter is necessary. Three perches are usually provided, two for feeding and one as a general resting place. A small swing may also be installed in either of these cages, but it is not necessary. From a careful examination of Figs. 15 and 16, it will be quite apparent that either of the two pedestals pictured can be easily converted into a parrot perch by adding a simple U-shaped piece of wrought metal to which a perch, made from a section of broom handle, is fitted. The feed cups in this section are mounted on the top ends of the U-shape, the water cup being riveted over a gasket so that it will not leak. Most parrots get along nicely without a cage, but a tray must be provided. Any cheap serving tray will do for this purpose and it is a simple matter to fasten it in place.



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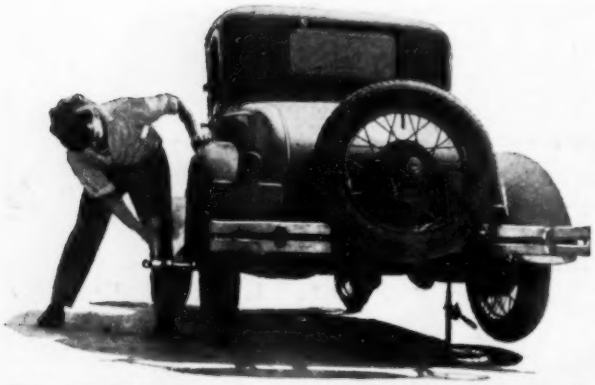
Obviously, many other types of bird cages of artistic design to suit your fancy can readily be fashioned along the same general lines as the ones described. New features and novel treatment will do much to popularize the sunny songbirds.



Rear Auto Wheel Removed by Jacking Up Opposite Wheel and Striking End of Axle with Small Sledge Hammer

Sledge-Hammer Blows Quickly Remove Rear Auto Wheel

In the absence of a puller, rear wheels on autos can usually be taken off in the following manner: Remove the hub cap, unscrew the axle nut until it is flush with the end of the shaft and jack up the opposite wheel. Then hold a hardwood block against the axle-shaft end of the wheel to be removed and strike it with a small sledge hammer as shown. The most stubborn wheel will usually give in to this treatment, and the axle assembly will not be harmed in any way.

Thumbtack Puller for Draftsmen Made from Film Spool

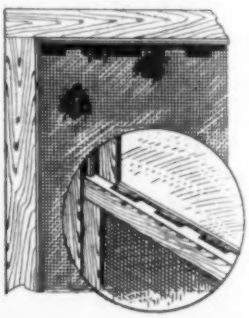
Thumbtacks can quickly be removed with a puller made from a camera-film spool, the flange at the key end being removed and a small wooden plug driven into the other end to strengthen it. Cut the plug flush with the end of the spool and then sharpen the edge of the flange by filing it down on the outside so that it can be pushed under the thumbtacks. Bend the part of the flange that was not sharpened slightly upward.

¶Black lacquer top dressing makes a good refinish for old rubbers.

Nut and Ball Used to Flare Copper Tubing

Flares for the couplings on the end of a gasoline feed pipe, or other copper tubing, can be made with a nut and a center punch or steel ball. Get a nut that will just slip over the end of the tubing, and make a cut through one side toward the center with a hacksaw. Also countersink one end, if possible, to obtain a better flare. After the coupling has been slipped on the tubing, push the nut over the end, with the countersunk side up and the tubing projecting about 3/16 in. Then clamp the assembly in a vise so that the nut squeezes the tubing just tight enough to hold it securely. A center punch or ball, slightly larger than the tubing, is driven into the end to flare it. To remove the nut, make another cut through the side to permit breaking it.

Notches in Screen Frame Provide Exit for Flies



Screens having notches cut in the upper rail of the frame for fly exits were specified by government inspectors for a large packing plant in Philadelphia. After extensive research, it was found that flies on the inside of a screen will walk upward and escape through these openings, but will not come down through them from the outside.

Convex and Concave Mirrors Aid Shaving without Glasses

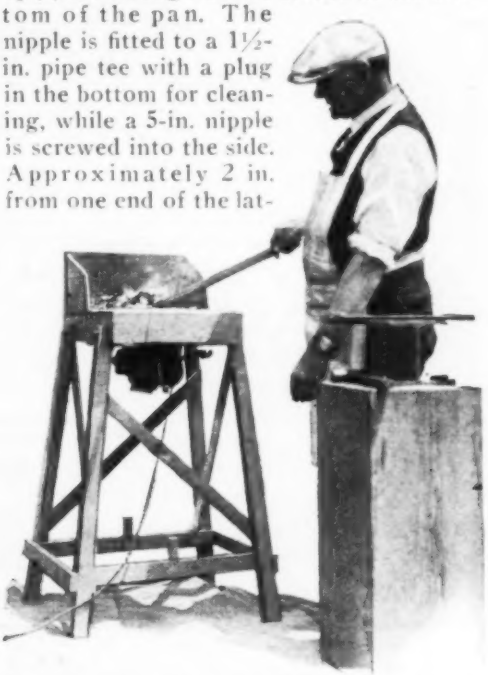
Men who must shave without their glasses sometimes find it rather difficult. The trouble can be overcome by using a concave mirror for far-sighted persons, or a convex one for those who are near-sighted. A concave reflector used on the old type of auto headlights has been found useful for this purpose.

This HOMEMADE FORGE *is Portable*

By E. G. Anderson

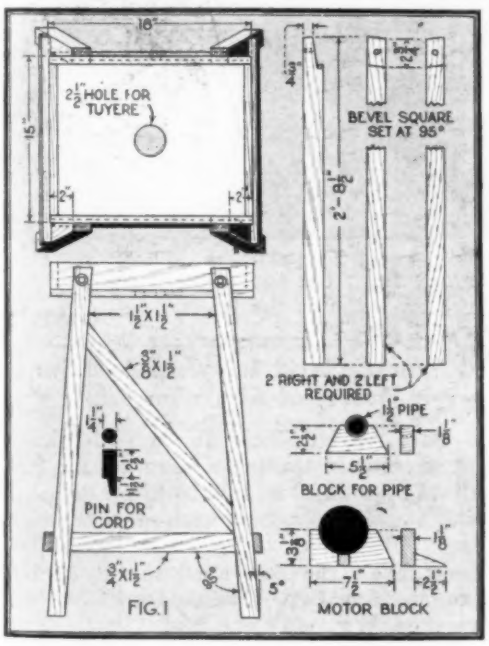
DRIVEN by an old but serviceable vacuum-cleaner motor, this forge is of use to the home craftsman as well as the farmer.

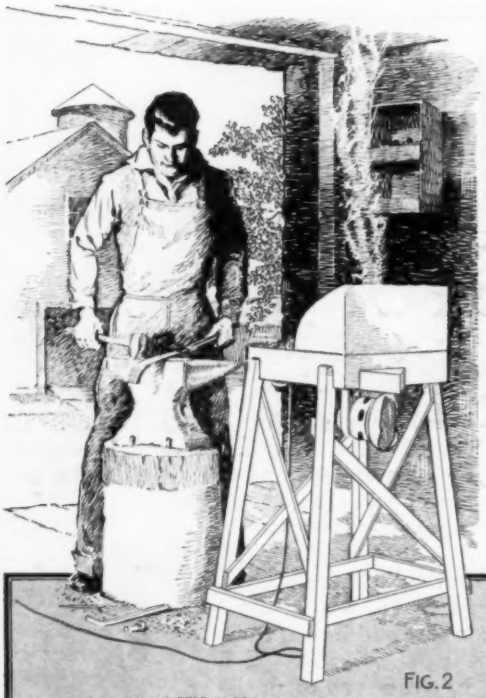
The fire box is an ordinary sheet-iron baking pan, about 14 by 17 in. in size. It is set in a wooden box of ¾-in. material, which is lined inside and out with 22-gauge sheet metal, the sides being about 2 in. deep. The legs and framework are similarly built of wood according to the dimensions shown in Fig. 1, where the side view and plans are given. A back shield is cut from 20-gauge sheet metal as shown in Fig.2, and screwed to the back of the frame, extending 9 in. along each side. A short 1½-in. pipe nipple and cap, in which a number of No. 11 holes are drilled, form the tuyere which projects up ¾ in. through a hole drilled in the bottom of the pan. The nipple is fitted to a 1½-in. pipe tee with a plug in the bottom for cleaning, while a 5-in. nipple is screwed into the side. Approximately 2 in. from one end of the lat-



Vacuum-Cleaner Motor Provides Draft of Air, the Volume of Which Can Be Controlled

ter, a vertical slot is cut about halfway through for a draft gate, which consists of two pieces of sheet metal cut to the shape shown. These are riveted together at the top and bottom to two ⅜-in. pieces of flat iron, which serve as slides. Triangular tabs are cut as indicated and bent at right angles to the face of the gate pieces, so that the tabs will fit the outside curvature of the pipe. They are attached to the latter by means of hose clamps,





fitted over the pipe nipple, and the motor is clamped to the underside of the top with a wooden block and two metal bands. As most cleaner exhaust ports fit nicely over the end of the pipe nipple, the connection will hardly need cementing. A switch, for turning on the current, is placed in a convenient position for the operator. The draft lever, made of suitable bar iron, is pivoted to the bottom of the pan box, and its movement is limited by two slides, also screwed to the underside of the top. The pivot point on the lever should be located so that the lever will move the draft slide in and out as far as it will go, although the slide will not entirely close the draft pipe.

To complete the job, the bottom and sides of the pan are covered with fire clay, the surface of the clay being sloped at an angle from the top edge of the sides to the top edge of the tuyere.

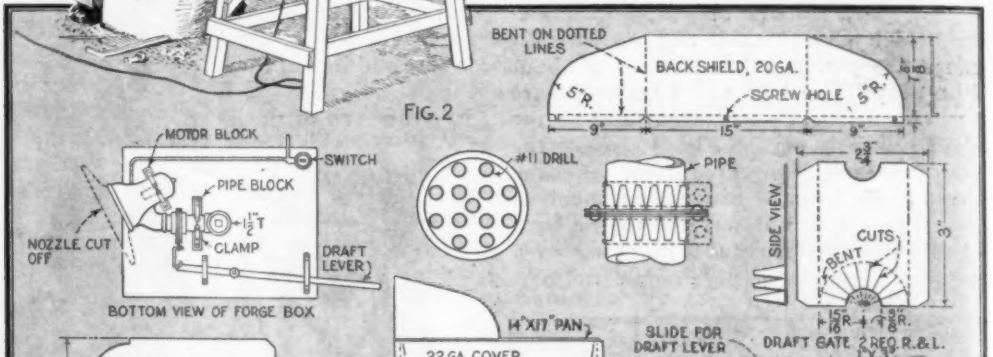


FIG. 2

which serve to hold them in position.

Next, the draft slide is cut from 20-gauge sheet metal, and a hole is drilled in the small projection at one end for a connecting link, between it and the lever, which is used to adjust the draft slide. To hold the assembly in position, 1-in. strips of sheet metal are clamped around the pipe with stove bolts, and are screwed to supporting blocks fastened to the underside of the top. The suction nozzle of the vacuum cleaner is cut off and the resulting hole is covered with wire mesh, while the exhaust port of the cleaner is

Muriatic Acid Improves Adhesive Quality of Aluminum Paint

Pure muriatic acid mixed with aluminum paint in the proportion of one-fifth of a teaspoonful of acid to ¼ pt. of paint, will cause it to adhere without first washing the surfaces. The cover should not be put on the can until the paint has stopped foaming.—Arthur Burkman, Milwaukee, Wis.

Woven-Wire Fence Stretched with Tractor

Using Your Tractor to Hold Woven-Wire Fencing Taut While Stapling It to Posts at Regular Intervals, Makes a Neat and Sturdy Fence besides Saving Time and Work

In putting up new fencing, you can use a tractor to stretch it. The fencing is unrolled and securely fastened to a braced post at one end in the usual manner. Two heavy pieces of 2-in. stock are clamped over the other end of the wire and these are in turn fastened to the drawbar of the tractor. The latter is then slowly driven forward until the wire is sufficiently tight. If the tractor is driven close to the posts and the fencing attached by means of a chain and a swivel joint, the wire can be set vertically and stapled to the posts at regular intervals, while it is held taut by the tractor. This method can also be applied to barbed-wire fencing with good results. Care should be taken, however, not to pull the fencing too tight, as it may be broken.

Dressing Tool for Emery Wheel

The surface of an emery wheel can be dressed satisfactorily with a tool made from 10 steel washers and a 6-in. length of iron rod threaded at both ends to receive a nut. The washers are slipped over the rod and the nuts tightened to hold them fairly close together, but without preventing them from rotating. The rod should be about ⅛ in. smaller than the diameter of the holes in the washers. In use, the tool is placed parallel to the surface to be dressed and held tightly against it while the wheel turns.—A. T. Lawton, Ottawa, Can.

Removing Sickle Blades

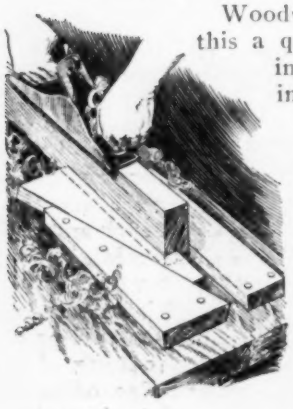
When it is necessary to remove sickle blades, try the method indicated in the photo. A length of 1½ by 1½-in. angle iron is screwed to the front edge of a workbench and the sickle is placed over it. A sharp blow on the projecting flat edge of each blade will shear the rivets off smoothly, one at a time, after which the blade is removed.

Fluting Work Done on Drill Press by Means of This Jig and Homemade Shaper Knife

Fluting on a Drill Press

Fluting can be done on a drill press by means of this jig, which consists of two short pieces of wood lapped over the ends of another piece as shown in the detail. The work is held in the jig by means of a nail at one end and a screw at the other, the latter being tightened to hold the work rigidly. Both nail and screw are, of course, driven into the center of the work. The cutting is done with a shaper knife mounted in an adapter, which can be made from a bolt of suitable size and held in the chuck.

Self-Adjusting Bench Stop

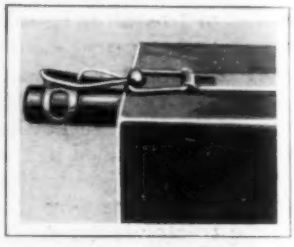


Woodworkers will find this a quick self-adjusting stop for holding work securely. Get a 4 by 12-in. length of stock and rip it across on a bevel, so that the two smaller ends will be 1 in. wide. Nail one of the pieces to the bench top and a 2 by 12-in. strip 1 in. from its wide end so that, when the other wedge-shaped piece is placed between them, the assembly will be 6 in. wide and 12 in. long. A ½ by 5-in. notch cut on the square side at the wide end of the sliding piece completes the stop. Place the work in the notch and push forward until it is gripped between the sliding wedge and the strip.

Correct Installation of Belts

There are a few things to remember when installing new belts. Be sure that the shafts are parallel and that the pulleys are in correct alinement; also that the belt is of the proper length and that the ends are cut square across where the splice is to be made. Splicing should be given considerable attention, whether the ends are laced or glued. It is not a good idea to cut the belt too short and then stretch it to make it fit, as this will weaken the material so that it will wear out faster and will also cause undue wear on the shaft bearings.

Measuring Tape Held in Position with Pencil Clip



When you are working alone and must measure work with a tape, a makeshift method of holding it in position is to use the clip on your pencil or pen, if the work allows attachment in this way. Hook the clip over the work with the ring in the end of the tape as shown.

Sorting Auto Crankcase Screws

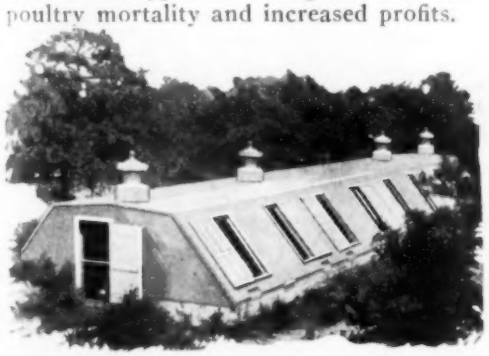
As crankcases on most autos are held on with bolts of different lengths, it is desirable to keep them separated in a suitable holder when the crankcase is removed. Such a holder can be made by drilling two rows of holes, to represent each side of the case, in a length of 2 by 4-in. stock. When removing the bolts, place them in corresponding holes in the holder, where the right bolt for each hole in the case is easily found.

Methods of Detecting Leaks in Cylinder-Head Gaskets

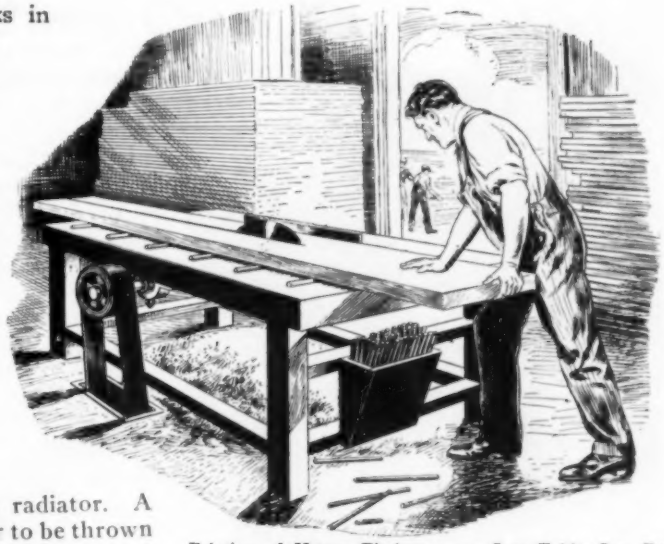
Leaky cylinder-head gaskets sometimes cause considerable damage to a motor by allowing water to get into the cylinders where it gets past the piston rings and into the oil, interfering with proper lubrication of the bearings. Slight leaks from the water jacket into the cylinder can be detected by opening the radiator cap and listening while the motor is running. If a leak is present, a bubbling sound will be heard in the radiator. A bad leak will cause the water to be thrown out of the radiator when the motor speed is increased. Leaks can sometimes be detected by an unaccountable loss of water after driving the car. On rare occasions, the gasket will blow out between the cylinders, interfering with firing.

Sunlight Reaches Entire Floor in This Poultry House

A poultry house designed and built by the owner of a farm at Medford, N. Y., has many advantages over the usual type. The overhead was reduced without sacrificing the floor space, thereby effecting a saving of 20 per cent in material. The walls were built at a 60° angle, which allows the sunlight to reach the entire floor through the windows. The owner claims that the more constant temperature possible in this type of building has decreased poultry mortality and increased profits.



Poultry House with Slanting Walls Allows Sunshine to Reach All Parts of the Floor



Friction of Heavy Timbers on a Saw Table Can Be Reduced by Using Dowel-Rod Rollers

Heavy Stock Rolled on Saw Table with Dowel Rods

Where considerable friction is encountered when pushing heavy stock over a saw table, the use of dowel rods as rollers will be found a great help. The rods are placed on the table at right angles to the saw blade and as the work is pushed along, additional rods are inserted under the feeding end, a supply of them being kept in a convenient position near the operator. The length of the rods depends on the width of the work, short rods being used on one or both sides of the cut. Those between the saw and the fence also must be short so that, if they happen to roll diagonally, they will not bind against the saw.—C. C. Ames, Mayville, N. D.

Celluloid Triangles Lettered with Nail Polish

Lettering can be put on celluloid articles, such as draftsmen's triangles, by using black drawing ink and liquid nail polish. First letter the objects with the ink and allow it to dry. Then brush the nail polish over the ink to provide a transparent film which cannot be rubbed or washed off. If desired, collodion may be used instead of the polish.

¶Two 8-in. sections of an old auto casing make good false jaws for a vise.

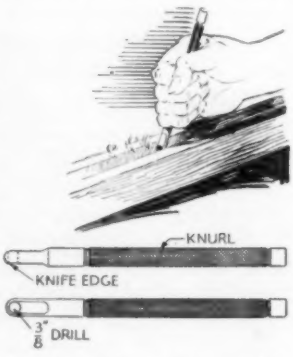
Old Lawnmower Chassis Fitted with Wooden Body Makes Handy Cart for Milk Cans

Old Lawnmower Serves as Cart for Milk Cans

An old lawnmower chassis was utilized by a farmer near Oakford, Ind., in making a milk-can cart. A wooden body was built on the chassis as shown, which was fitted with handles so that it could be pushed along. For rubber-tired wheels, stretch a section of inner tube over them.

Carving Tool Made from Drill Rod

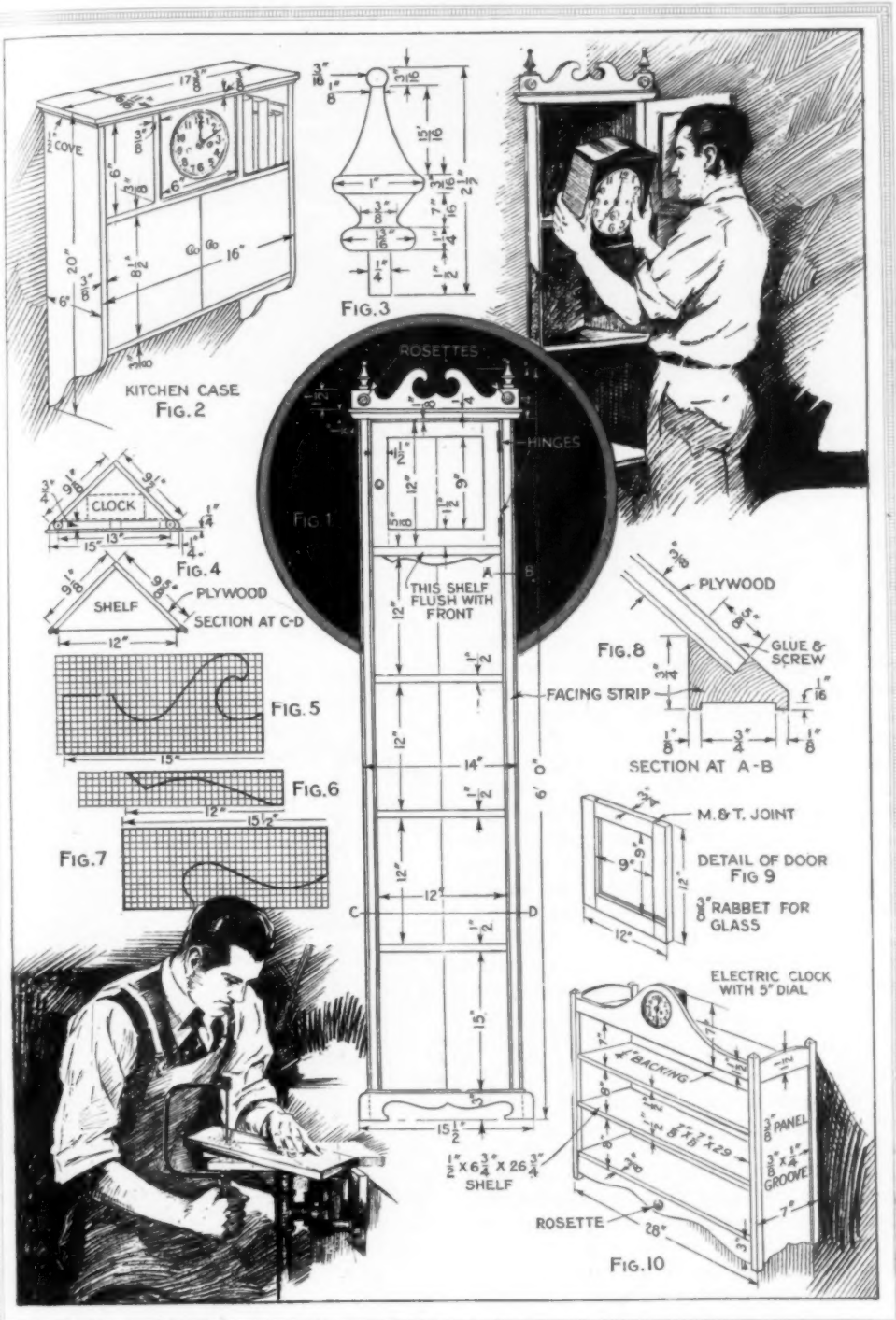
This carving tool, which enables one to get into out-of-the-way places more easily, is made by flattening one end of a length of drill rod with a file and drilling a ⅜-in. hole in it as shown. The rod is then tempered and ground to a knife-edge. Such a tool will also be found to be much easier on the hands than the usual type. The handle may be knurled to permit gripping it firmly.—Deane B. Caldwell, Los Angeles, Calif.



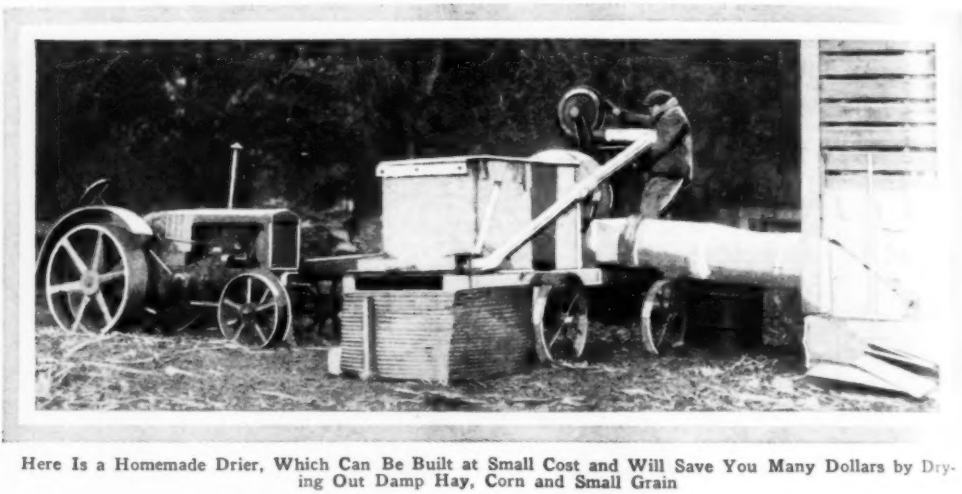
Novel Cases for Electric Clocks

A clock in every room, and why not, when a synchronous motored clock requires little care and attention? The corner clock shown in Fig. 1 is a novel and attractive piece of furniture, which serves both as a timepiece and a shelf. Plywood panel stock for the back, shelves, skirt and crown, and white solid stock are required for the facing strips and door frame. Fig. 8 shows how the formed facing strips are made. Screws and glue are used to fasten the back to the strips, the screws being driven from the outside. Fig. 9 gives the door construction, which is a rabbeted mortise-and-tenon joint. The glass is fastened into the rabbet with strips. Fig. 4 shows a section above one of the shelves, from which the shelf size may be obtained, and also the size of the back panels. The dimensions for the turned finials are given in Fig. 3. If you have no lathe, brass or turned wood ornaments may be purchased that will serve the purpose. The patterns for the formed pieces may be obtained from Figs. 5, 6 and 7, the curves being cut with a band or coping saw. The door is hinged as shown, and a catch holds the door closed. The hanging book shelf, Fig. 2, is suitable for a den, library or living room. A box accommodates the clock movement, as shown, and is fastened to the front panel. This should be as nearly dust-tight as possible but accessible if necessary. If an outlet is arranged in the wall directly behind the clock, it will make a neat installation. Screws driven through the back at the points where the studs are located provide a suitable fastening. Hooks are not advisable because of the weight of the books. The kitchen case shown in Fig. 10 is intended for recipes and cook books but can be used as a spice cabinet with slight changes. The case is light and can be suspended from strong hooks or fastened as previously described. The material and finish for any of the clock cases will depend on the furnishings of the room in which they are to be used. The corner clock will work up best in walnut or mahogany, while the kitchen case requires soft wood for a paint or enamel finish. An electric clock having a 10-in. dial is about right for the corner clock, and smaller ones for the other pieces.

Novel Electric Clock Cases You Can Make



Drying Out Cribbed Corn Prevents Spoilage



Here Is a Homemade Drier, Which Can Be Built at Small Cost and Will Save You Many Dollars by Drying Out Damp Hay, Corn and Small Grain

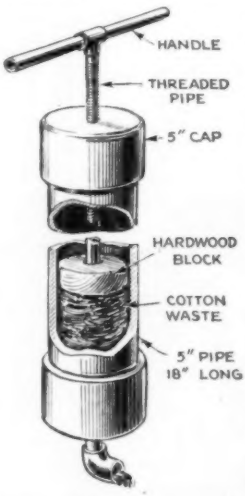
A corn drier has recently been developed and successfully used by the agricultural engineering staff of Purdue University, the purpose being to dry moist corn that has already been cribbed. The apparatus consists of an oil heater installed in a large box set on a wagon chassis. A small fan is used to draw outside air into the heater compartment, while a large fan forces the hot air through a sheet-metal pipe to the crib, both fans being connected so they can be run by a tractor. The exhaust pipe is provided with flexible connections of canvas so it can be placed inside the crib where needed. The burner is supplied with oil from drums set on the ground near the wagon. To make the process more efficient, building paper should be nailed around the crib to hold the heat. This apparatus can also be used for drying out green or wet stacks of hay, and for drying out oats and wheat that have been treated for smut.

Paper Prevents Colors on Paint Brushes from Mixing

In applying several colors on a paint job, the brush has to be cleaned every time a different color is used, or if a brush is provided for each color, a separate can of oil is needed for those not in use in order that the colors may not run together. By wrapping a piece of paper, or a small paper bag, around each brush, all of them can be kept in the same can, as the paper prevents the colors from mixing.—Chas. Illingsworth, Vancouver, Can.

Press for Cleaning Oily Waste

Cotton waste can be reclaimed and used again by removing the oil with this press. It consists of a length of 5-in. pipe nipple, two caps and a plunger. One cap is drilled for the shank of the plunger, which is a 1-in. pipe threaded its entire length and provided at one end with a hardwood block fitting inside of the nipple, while the other end is fitted with a tee and two nipples to serve as a handle. The other cap is drilled and tapped for a nipple as an outlet for the oil. In use, the waste is put in by removing the top cap and taken out by removing the bottom cap. If the waste is boiled for 15 minutes in a solution of soda and water after the pressing, it will dry fluffy.

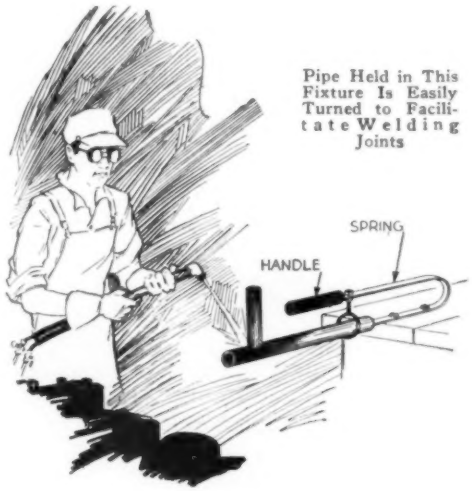


Leaky Intake-Manifold Gasket Causes Misfiring

Misfiring of an auto motor at low speeds sometimes is due to a leaky gasket on the intake manifold. A small leak causes it to misfire at low speeds, while a bad leak makes the motor miss at all speeds. To locate the trouble, squirt gasoline around the intake gaskets while the motor is running. The vacuum in the manifold will draw this gas into the motor if a leak is present, and will change the running rhythm sufficiently to be noticed, causing the motor to speed up or slow down. The sucking sound made by the motor drawing this extra gas into the manifold may also be heard.

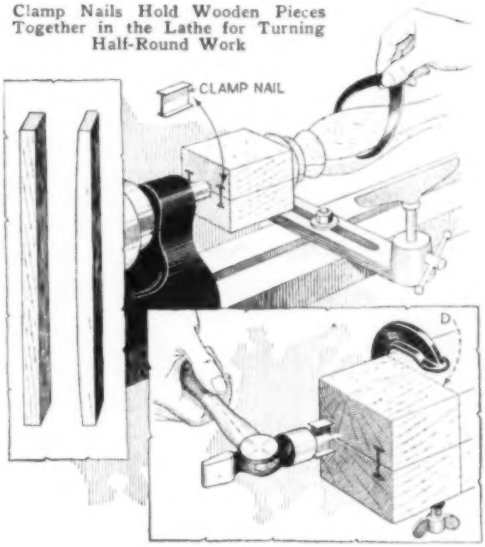
Pipe Joints Are Easily Welded with This Holder

Welding pipe joints is facilitated by the use of this fixture which holds the work firmly, yet allows it to be turned back and forth. A piece of flat spring steel is bent to the shape shown and bolted to the bench, while a length of iron rod, formed into a ring at one end and threaded at the other, is attached as indicated. A short pipe, driven onto the upper end of the spring, forms the handle and completes the job. The work is slipped over the lower end of the holder and is kept in place securely by the ring. It is released by pressing down the handle. The size of the holder varies with the work for which it is intended.



Pipe Held in This Fixture Is Easily Turned to Facilitate Welding Joints

Clamp Nails Hold Wooden Pieces Together in the Lathe for Turning Half-Round Work



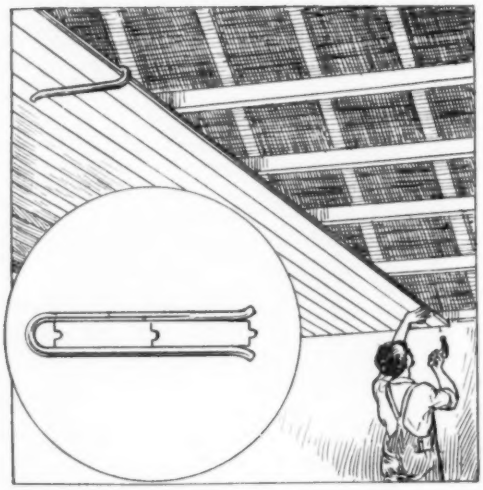
Clamp Nails Hold Work Together for Split-Wood Turnings

Halved, or split-wood, turnings, such as are used for decorative purposes on cabinetwork, can be made with less work by using clamp nails for holding the pieces together while turning them. Plane the side of one piece so that the surface is slightly curved, as shown in the upper detail, and cut kerfs for the clamp nails in the ends of both pieces, placing them so that they will not interfere with the lathe centers, or with the turning tool. The pieces are clamped together and the nails driven into them. The work should be long enough to allow 1½ in. to be sawed off at each end in order to remove the nails, as shown by the line D, after which they can be split out and used again.

A Compound for Lapping In Gears

A compound for lapping in gears can be made as follows: Mix thoroughly No. 3F Carborundum brand silicon carbide, 1 lb., mesh garnet, 14 oz., machine oil, 1 qt., and add ½ lb. of cup grease. Pour this compound into the gear housing, and set the gears in motion. When they are lapped in, wash out the housing carefully as the compound will damage the gears.

¶To prevent the threads on an electric soldering iron from rusting, spread ordinary rosin soldering paste over them.



This U-Shaped Clamp to Hold Ceiling Stock Takes the Place of a Helper

A Clamp to Handle Ceiling Stock Single-Handed

When no helper is available, you can handle ceiling stock alone by means of a flat-iron clamp to hold the free ends. The clamp is made of 1 by ¼-in. stock, 24 in. long, and is bent over the center so that it will grip the boards lightly. The ends should be bent outward slightly, so that the tool can be slipped over the work. In use, the clamp is slid over the ceiling boards already nailed in place, allowing it to project far enough to allow the insertion of another piece. With one end of the stock supported in this way the worker can start nailing at the other end.—Roger C. Dickey, Salem, N. H.

Fuel Surge in Carburetor Stops Motor

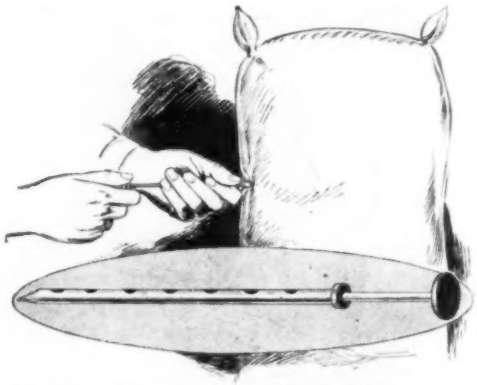
Stalling of a motor, when starting or stopping a car, is often caused by a surge of fuel in the float chamber of the carburetor. If the chamber is placed toward the front of the motor, the fuel tends to surge away from the fuel jet when the car comes to a stop, thus "starving" the motor. If the chamber is placed toward the back of the motor, the surge will flood the jet and cause a too rich mixture. The remedy depends on which of these conditions prevails. In case of an overrich mixture, set the carburetor as lean as possible when idling. If the trouble is caused by too lean a mixture, the idling-adjustment screw should be opened slightly, to overcome the tendency to stall. In some cases stalling is caused by too slow idling. The car should be driven and the adjustment set for 3 to 5 miles an hour, as may be necessary.

Durable Barrel Hoops from Old Sprocket Chain

Old sprocket chains that accumulate on the farm provide satisfactory barrel hoops that will outlast those of strap iron. Hook the ends of the chain together, after reducing or increasing the length, so that it will have to be driven onto the barrel. If the chain is not long enough, you can get a hoop of the proper size by linking the ends together with a wire, threaded back and forth several times.—Luther Strosnider, Onaga, Kans.

Tubular Sampler Removes Seed from Center of Sack

A seed-supply house in Phoenix, Ariz., uses a 15-in. length of seamless brass tubing, pointed at one end, for quickly taking seed from a sack for testing purposes. Several holes are drilled along one side and the tube is fitted with a sliding plunger which closes the holes. In use, the plunger is pushed in and the tubing pushed into the sack. Then the plunger is pulled back to allow the seeds to fall into the tubing. With this method, the seeds can be taken from the center and sides of the sack in one operation.



Seeds Are Taken from the Center and Side of a Sack with a Tubular Sampler

Extension Brazed to Sheared Studs Helps Remove Them

Studs that have been sheared off can be removed by using Tobin bronze to braze an extension piece to them so that they can be turned out with a pipe wrench. To do this, drill a small hole through the broken stud, if possible, to allow for expansion caused by the heat and tin the end with Tobin bronze. Then tin the end of another stud or steel rod of the same diameter and braze it to the end of the broken stud with the aid of a bronze rod. If the break is dirty or rusted it will be necessary to roughen it with a chisel or prick punch before tinning. The bronze will not adhere to the casting unless it is clean. Confine the heat as nearly as possible to the break, as this will aid by slightly expanding the surrounding metal. By working rapidly, the heat will not endanger the casting, due to the low melting point of the bronze. This method has been found successful where others have failed.

Print Roller from Typewriter Platen

Fitted with a metal frame and a handle, a typewriter platen will form a good print roller. The frame is made of ⅛-in. steel, bent to the shape shown and drilled at each end to receive the platen shaft. The handle is made of the same material as the frame, one end being welded or brazed to the frame, and two wooden pieces riveted to the other end form a comfortable grip.

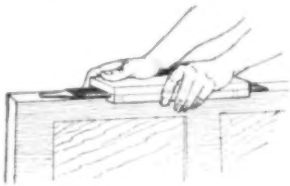
Connectors for Electricians' Testing Equipment

Connectors for electricians' and repairmen's testing equipment can be hooked into a circuit at almost any point without extra work and connected on wire without removing the insulation. To make these, cut a piece of brass to U-shape. Drill and tap holes in each leg, one for a screw, fitted with a fiber or bakelite head and pointed at the other end to penetrate insulation on the wire, which is held in a groove filed on the inside of the opposite leg. The other hole takes a piece of brass rod, split and shaped to enable attachment to switch points or busbars. Drill a third hole in the bottom of the U-shaped piece for a handle, consisting of a length of brass rod threaded at both ends, one end being bent at right angles, while the test wire is soldered to the other. A fiber or bakelite sleeve is then turned on and test wire connected to the latter.

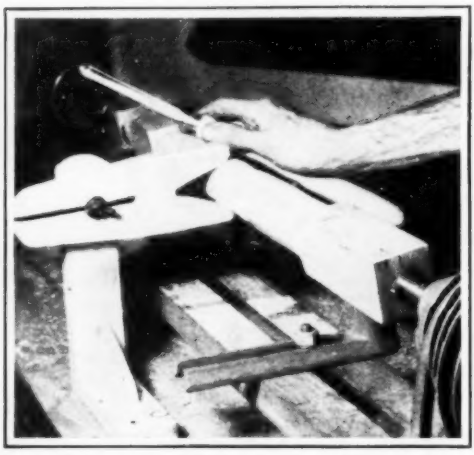
Electrical Circuits Can Be Tested at Most Points with These Connectors without Removing Insulation

Coarse File Used as Plane for Edging Boards

Mounted in a suitable holder, a rasp or coarse file will often serve the purpose of a plane for edging boards. The holder consists of a wooden block and two strips of molding, which are grooved to fit over the edges of the file. The file is then placed in position and the molding, which holds the file firmly to the block, is screwed on. In use, the file is placed against the edge of the work as shown and drawn back and forth, the pieces of molding serving as guides.



Steady Rest Prevents Vibration of Long Work on Lathe

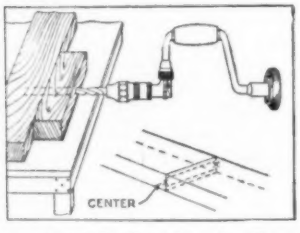


Improvised Steady Rest Prevents Vibration When Turning Long or Thin Work on a Lathe

Excessive vibration, often experienced while turning long spindles in a lathe, can be overcome by using the steady rest shown. It is made of wood and consists of an upright piece of suitable length clamped to the lathe bed at a point approximately midway between the lathe centers. A crossarm, having a V-notch cut in one end to accommodate work of various diameters, is fastened to the upright with a wingnut and bolt, which is fitted into a slot cut in the other end to allow for lateral adjustment. In use, a smooth place is turned on the work to receive the notch in the crossarm, which is then adjusted to fit firmly against it. This will steady the work.

Guide for Bit When Drilling Dowel Holes

Dowel holes are sometimes rather difficult to drill straight without a guide. One can be made by squaring a line around a wooden block, of the same thickness as the work, which should be similarly squared beforehand. Center-mark the opposite edges and drill a hole of the proper size about halfway through, then, starting at the center on the opposite edge, drill a hole to meet the first. This will provide a true hole to guide the drill when the block is held against the work.



Steel Wool Cleans Welding Torch Tip

Frequent rubbing with steel wool, or with fine emery cloth, will keep the outside and end of an acetylene torch tip free of incrustation. It may be necessary to have a reamer of the correct size to clean the inside of the tip. A handle can be made from a short piece of round or hexagon stock, soldered to the reamer to aid in twisting it through the tip. This method of cleaning will not distort the cone, as is sometimes done when it is rubbed against a brick to clear the tip.

Spur on Hammer Provides Grip When Shingling Roof

You may prevent an injury in slipping from a roof, if you fit your hammer with this safety spur. It is a ⅜ by 5⁄8-in. piece of triangular steel tapered to a point and welded on the side of the hammer as shown. The spur is slightly curved, and should you slip, you can immediately check the fall by digging the spur into the roof.

Washer Stops Oil Leakage on Electric Fans

The armature shaft on electric fans in time becomes loose enough to jerk back and forth, and unless oiled by a wick, it throws oil on the blades by which it is ejected all over the room. To remedy this trouble, remove the blades and slip a metal washer over the shaft so that it fits tight enough to turn with it. Then put on a fiber washer and replace the blades, pressing them against the washers, and tighten the setscrew that holds the blades.

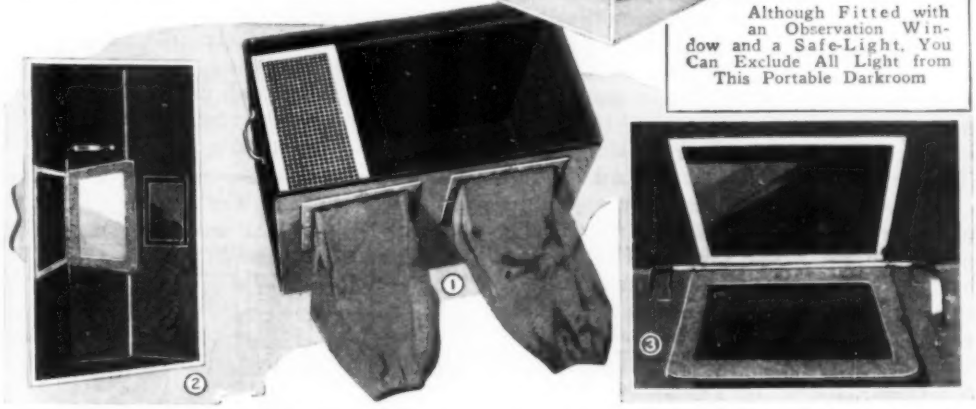
PORTABLE DARKROOM *Develops Your Photos* ANYWHERE

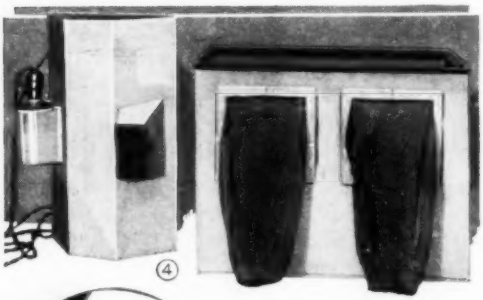
By Floyd Suiter

WHEN photos must be developed on the job, where there is no access to a darkroom, this portable outfit solves the problem of providing a light-tight place to do the work, which is especially necessary when using the extra-rapid panchromatic films and plates. Besides being useful for developing, it is also convenient for loading holders and magazines.

As the box measures 12 by 24 by 18 in., it is easy to carry around, two handles being provided on the ends for this purpose. The material used in its construction is light-gauge steel or galvanized sheet iron, all edges being bent to fit snugly and then soldered. The box is made in two parts—the body and the cover—as shown in Fig. 4. The edges of the cover are flanged as in Fig. 5 so that they project over on the inside. A layer of felt is placed all around the top edge of the box on which the cover rests and the projecting edge inside fits closely, to exclude all light. The top edge of the box is bent over a length of wire, care being taken to get it perfectly straight. Two square openings are cut in the front of the box for light-tight sleeves, made of rubberized material and fitted with elastic bands to close around the arms. The sleeves are about 15 in. in length and 7 in. square. They are attached to the box by means of metal angle plates which are bolted to the box as indicated in Fig. 5. Angle-iron ledges are screwed to the inside of the box, near the top edge, to hold a sliding shelf as shown in Fig. 1, which is a convenient place for empty plate holders and film packs. Observation of the work from the outside is possible through a small hooded window, the edge of which is cut to fit the forehead and nose and all edges are padded with felt for comfort. A piece of ruby glass is mounted permanently on the inside of the cover directly under the window, and a hinged door is fitted on one side of the glass, as shown in Fig. 3, so that it can be swung over to close the entrance, if desired. The edges of the door are padded with felt to exclude light, and a coil spring is arranged to hold it tight in a

Although Fitted with an Observation Window and a Safe-Light, You Can Exclude All Light from This Portable Darkroom





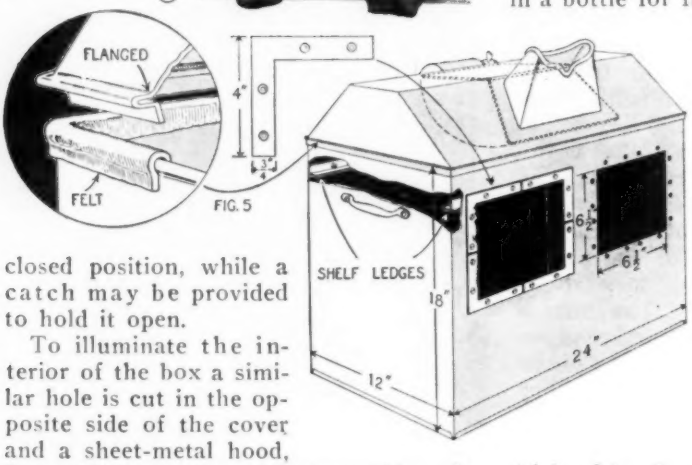


FIG. 5

closed position, while a catch may be provided to hold it open.

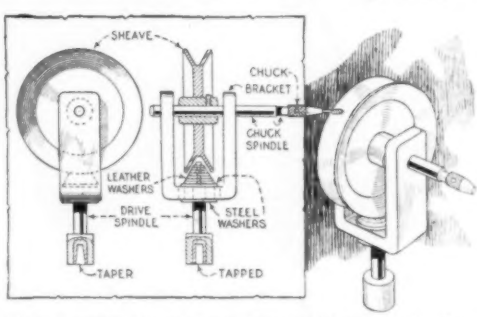
To illuminate the interior of the box a similar hole is cut in the opposite side of the cover and a sheet-metal hood, for holding a suitable photographic safelight, is soldered or riveted over the hole. An extension cord is provided to permit plugging in at any convenient outlet. Amber or ruby-colored glass can be interchanged in a slide, inside of the cover and directly under the lamp, if desired. It is also a good idea to provide an opaque cover at this point to exclude any light when developing panchromatic films and plates. Fig. 2 gives a view of the inside of the cover, showing both the window and the illuminating opening. The interior of the box should be painted dull black to minimize the possibility of light reflection, while the exterior may be painted any color to suit your fancy.

How to Extract Attar from Roses

If you have a number of rose bushes around your home, it is a simple matter to extract the attar from the petals and make a high-grade perfume. Get a gallon jar with a fairly wide mouth, such as a mustard jar, and fill it with the fresh petals, pressing them in tightly. Next put strips of a sponge in pure olive oil and place them in a 2-oz. vial that will fit tightly over the mouth of the jar. Set the jar outdoors where the sun will shine on it and let it stand for at least a week. The heat will distill the petals, while the aroma rising into the sponge will be absorbed and held by the oil. More roses should be added as space becomes available. After the strips of sponge have been thoroughly saturated with the attar, they are placed in a bottle for future use. As the fluid is volatile, the bottle should be kept tightly corked.

Tapping Attachment for Lathe or Drillpress

Anyone can make this tapping attachment which can be attached to a bench lathe, drillpress or an emery wheel. No dimensions are given as they will depend on the facilities at hand and the kind of machine on which it is to be used. First get a suitable length of ½ by 2-in. flat iron and bend it to a U-shape as shown. Drill a hole in each end to receive the chuck spindle. The sheave can be turned out of aluminum, if one cannot be purchased, and is held on the spindle with a setscrew in the hub. This also holds the spindle from slipping out



This Tapping Attachment Can Be Made to Fit Your Lathe, Drillpress or Emery Wheel

of the bracket. As the sheave is driven by friction against leather washers on the end of the drive spindle, the play between the hub and the brackets should be greater than the play between the washers and the groove in the wheel. The drive spindle is turned to a suitable size and either

tapered or tapped at the lower end for driving convenience, while the upper end is threaded and fitted with a nut which holds the washers in position. Steel washers are placed over the spindle on each side of the bracket to hold it in position. The leather washers are put on the end of the shaft and tapered to conform with the groove in the sheave, but the taper should be slightly less than that of the groove to afford a neutral position for the wheel. In use, the pressure of the work against the tap will force the wheel against the leather friction drive, and the motion can be reversed by pressure on the opposite end of the chuck spindle.—F. J. Wilhelm, Cincinnati, Ohio.

Ignition Trouble Indicated by the Ammeter

Certain kinds of ignition trouble can be detected by closely watching the dash ammeter while the motor is being cranked. If the ammeter shows a current flow when the ignition switch is first turned on, and then drops to, or near, zero, a partially open circuit is likely to be the cause of the trouble. This can be checked by cranking the engine with the starter and observing the movement of the ammeter hand. If it swings regularly to between 4 and 6 amp., this part of the system is in good condition. But if the hand does not indicate regularly the opening and closing of the timer points, the trouble may be in the low-tension side. The most common cause for this trouble is that the timer points have become burned or dirty, which can be checked by turning on the ignition switch and shorting the points with a screwdriver. This should show a normal current flow on the ammeter and a good spark when the screwdriver is moved. Other causes for ignition trouble are loose contacts, broken wires and poor contacts in the switch.

Extension Light Fastens on Cap

Light on Auto Mechanic's Cap Throws Light Where Needed and Leaves Both Hands Free

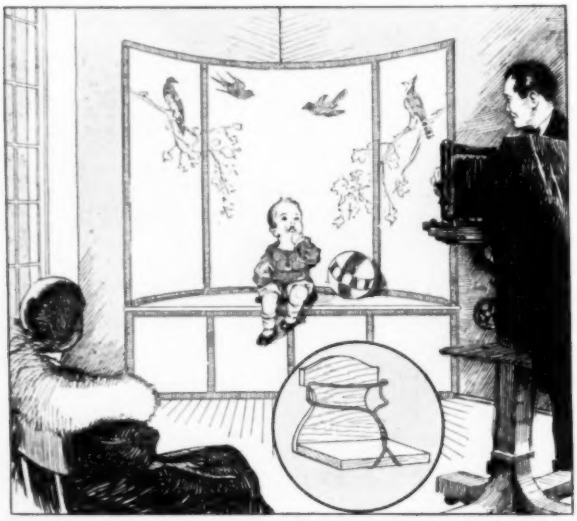
Here is an extension light for the auto mechanic, which has been found a great improvement over the usual type, as it leaves both hands free and throws the light where needed. It is made from a piece of bakelite fitted with a 6-volt lamp and socket, and a suitable length of cord so that the current can be taken from an auto battery, or from the 6-volt tap of a transformer connected to the 110-volt lighting circuit. If desired, a guard can be provided to avoid breakage of the lamp. For constant use in the shop, the 6-volt lamp may be replaced by a miniature or candelabra type that works directly on 110 volts, thereby eliminating the transformer. The base is attached to the worker's cap so that the lamp can readily be removed.

For Your Workshop

AN attractive 16 by 23-in. table giving both the decimal and metric equivalents of the fractional parts of an inch, for use in the home workshop as well as the drafting room, machine shop, garage, etc., will be sent to anyone upon receipt of 10 cents to cover mailing costs. Address Book Dept., Popular Mechanics Magazine, 200 E. Ontario St., Chicago.

Coppering Solution for Oily Steel

A coppering solution that will stick to oily steel consists of the following ingredients: ½ oz. sulphate of copper dissolved in 4 oz. of water and a teaspoonful of sulphuric acid added drop by drop.



When Covered with the Baby's Clothing, This Sturdy Seat Cannot Be Seen in the Finished Photo

Corner in Photographer's Studio for Baby Pictures

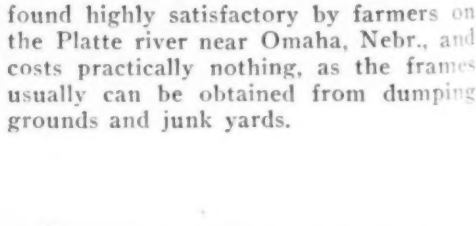
To hold a baby securely, yet inconspicuously, is a simple matter with this seat, which has been used successfully by a photographer of Urbana, Ill. It is made of ¾-in. wood, fitted with a wire support at the front to prevent the baby from falling forward. This, of course, is carefully covered with the clothing so that it will be almost unnoticeable in the finished photograph. A suitable background is also provided, which can be made from wallboard nailed onto a wooden frame, and, if desired, arranged to fit in a corner, a seat being formed in the frame.

Removing Stiffness from Round Leather Belting

Round leather belting, particularly of ⅜-in. size, often gives trouble when run over small pulleys at high speed. This is generally due to the stiffness and spring of the leather, and also to the method of cutting it, the result being that there is nearly always some place in the belt that is slightly kinked. This misalinement, together with the natural stiffness and spring of the leather, causes the belt to twist and ride up on the small pulley with consequent pounding and loss of power. To offset this tendency, it is necessary to run the belt very tight, and this practice places a far too heavy load on light bearings, resulting in undue wear. To remedy the trouble, remove the belt from the pulleys, take out the wire splice and then get a piece of ½-in. steel shafting that is bright and free from rust. Lock this vertically in a vise, allowing it to project above the jaws about 4 or 5 in., and apply a few drops of heavy oil to the shaft so that the belt will slip over it easily. Then loop the belt one turn around the shaft, take hold of the free ends, one in each hand, draw tight and pull the belt back and forth in long strokes. Finally, crimp the ends between the fingers, bending the leather first one way and then the other. This operation does not damage the belt, but breaks the grain, eliminating its spring and resiliency. Never soak the belt in oil, as this treatment softens the leather and causes it to stretch unduly. Oil also causes the surface of the belt to become glazed so that it will slip under a load. Replace the belt, giving just enough tension to prevent it from vibrating, and it will run smoothly and will "hug" the pulleys.

Barrier of Auto Frames Prevents Erosion of River Banks

Placed parallel to the river bank, an effective barrier which collects considerable debris, can be made from old auto frames set on end and wired together as shown. Such a flood fence has been



Battery of Auto Frames Wired Together Forms Effective Flood Fence on River Bank

found highly satisfactory by farmers on the Platte river near Omaha, Nebr., and costs practically nothing, as the frames usually can be obtained from dumping grounds and junk yards.

How to Set Up and Use a
Home Workshop Shaper

By W. Clyde Lammey

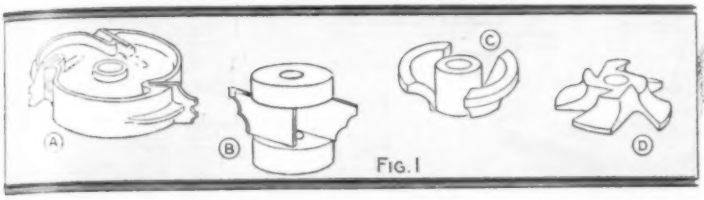


FIG. 1

Various Types of Cutters for Small Shapers Permit an Infinite Variety of Molding Shapes

MOTOR-driven vertical-spindle shapers are now available at a price within easy reach of the small shop owner. Four types of shaping heads for use with these are shown in Fig. 1. The first, A, a three-knife head, furnished with four sets of cutters, is practical for use in the small shop where the cost of a complete assortment of molding heads would be prohibitive.

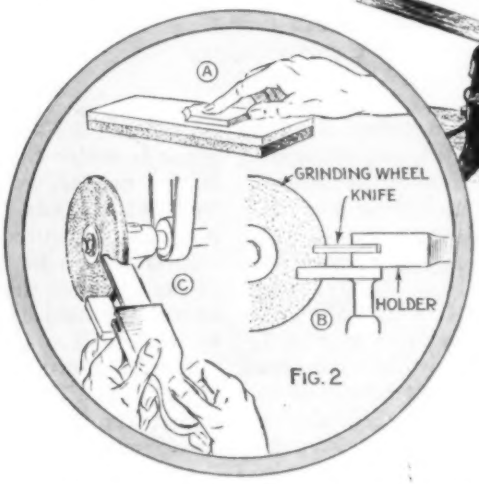
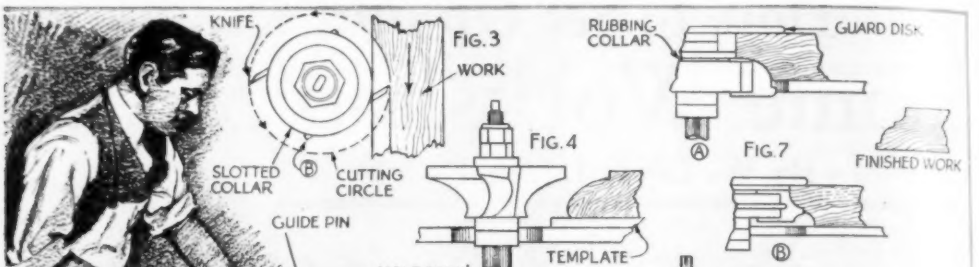
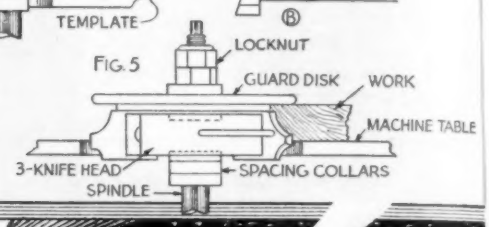


FIG. 2

To produce clean, smooth moldings, the cutters must be carefully ground to a keen edge. Fig. 2 indicates a method of grinding the knives fitting the heads shown in details A and B of Fig. 1. The single cutter of the three-knife head is held as in detail A, Fig. 2, the grinding being done on the fine side of an oilstone. The bevel-edged knives fitting the second head are generally furnished as blanks and must be ground to the form desired. This is easily done as at B and C of Fig. 2. By making a slotted holder for the knife, the cutter is first ground square across the end. A ¼-in. round-faced grinding wheel must be used when the knife edge is curved. Grind both knives to the exact form desired, using the first as a template in grinding the second. Then bevel to a cutting edge as in Fig. 2, detail C, the length of the bevel being about 1½ times the thickness of the knife. Take care not to alter the form of the knives, one from the other, and when the knives have been set up between the slotted collars, make sure that the heel of the knife, indicated by B in Fig. 3, clears the edge of the stock. To insure this, it may be necessary to shorten both knives equally by grinding back the square end. Also take care that the knives are exactly the same length to assure perfect running balance of the head. The two cutters, shown in details C and D of Fig. 1, are known as the "wing" type, the cutter head C having four cutting edges, two of which cut while rotating in either direction. Both heads are easily sharpened with a file and the edges honed with a beveled slipstone.

Fig. 5 shows a set-up of a three-knife





head, and from this it will be noted that the cutting is done from underneath, and that the rotating knives are covered with a guard disk, which also acts as a hold-down. The table of the machine can be adjusted up or down to form the molding desired. When making this adjustment it is necessary to make sure that the portion of the work untouched by the knives is guided by the rubbing collar directly under the guard disk, as shown. Details A and B of Fig. 7 show a set-up of the same head to form a molding in two passes and one change of cutters, the thickness of the stock being greater than the width of the cutters. Fig. 4 shows a set-up of the molding head D of Fig. 1, the shape of the cutters being such that the stock to be molded must be tacked to a template which rides on the rubbing collar. Where the edge is curved, such as that of a tilting-table top, for example, the template is cut roughly from thin stock, tacked to the under edge of the work and band-sawed along with the work, the operation insuring uniformity between work and template.

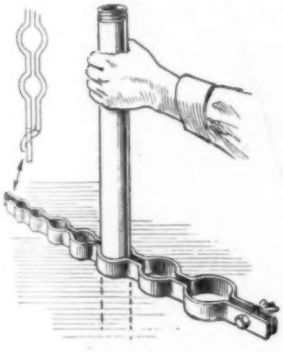
Occasionally the shape of the work makes it necessary to provide an improvised hold-down, more particularly where the stock is thin and the edge to be molded is curved. Such work must be guided by a pin at the beginning of the cut. This accessory is provided with the machine, and a number of holes are drilled and tapped through the table so that the pin may be placed in different positions about the head. The use of the guide pin and hold-down is shown in Fig. 6. Where the work is wider than 4 in., the hold-down is not needed, as it may then be safely held in the hands. The guide fence, which also is furnished with the machine, should always be used on straight work. If such work is thin and narrow, it is best to use the hold-down indicated in Fig. 6, as this will aid in holding the work against the cutters without danger to the hands. The hold-down may be easily sawed from a block of hardwood, one end being rabbeted as shown to allow the stock to slide under. It may be fastened to the table with a thumbscrew and locknut, turned up in one of the several threaded holes.

Shapers of the vertical-spindle type may be used for cabinet-making operations other than forming moldings, an example of which is shown in Fig. 8, where it is necessary to groove the inner edge of a curved door rail to take the panel, an operation virtually impossible with any other tool. A small saw blade is set up on the spindle as shown, a guide collar being turned from wood and placed on the spindle under the blade. The diameter of the collar should be such as to allow the blade to cut the required depth.

"Snap" Method of Adjusting Connecting-Rod Bearings

By using the "snap" method of testing connecting-rod bearings in checking their adjustment, it is unnecessary to crank the engine. The slight end play present in most such bearings is made use of in making the test. First tighten the bearing to a point which is approximately correct. Then apply pressure, first in one direction and then in the other. If the bearing is too loose, it will move without snapping, and if too tight, the pressure exerted by the hands will be insufficient to move it on the shaft. A distinct snap can be heard when the bearing is adjusted correctly. This method also can be used on bearings that require a specified clearance by placing a strip of shim stock of the required thickness in the bottom of the bearing cap, and then adjusting the bearing until it snaps, after which the shim is removed and the bearing cap tightened in the usual way.

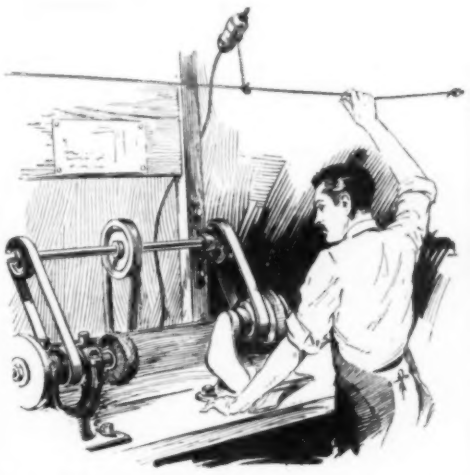
Plumbers' Clamp Holds Many Sizes of Pipe



Here is a useful clamp for holding pipe when making connections between floors. Two lengths of 1½-in. bar iron are bent to the shapes shown, to accommodate pipes from 1½ to 6 in. in diameter. The bars are interlocked at one end, while holes are drilled at the other ends for a bolt and wingnut to hold the pipe securely.

A File for Different Grades of Sandpaper

Sheets of standard-size sandpaper cut in four pieces are handy to use and help eliminate waste. A small box, partitioned to hold several grades of the paper, will make it easy to select the proper kind when needed.



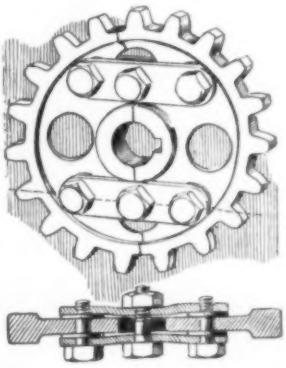
Home Workshop Machinery Can Be Controlled with Cord Fastened to a Pull-Chain Switch

Safety Switch for Home Workshop

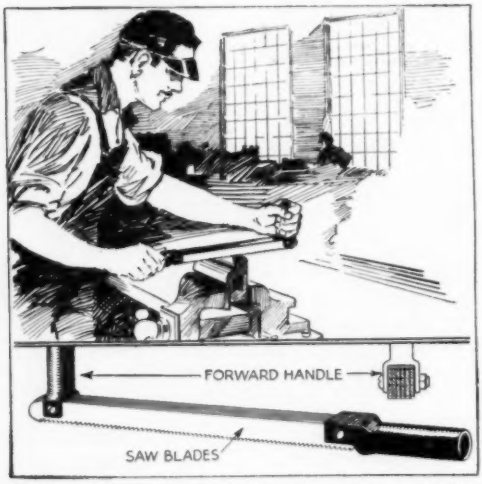
When a pull chain is used at the source of supply for your workshop machinery, a cord running horizontally and tied to the switch will operate it at any point along the bench. The pull chain should be taut so that a slight motion will throw the switch. It is still better to have a pull-chain socket mounted on a rigid base.

Making Split Gears for Model and Experimental Machines

Split gears for model and experimental machinery can be made as follows: Get a solid gear of the proper size, drill holes through the web for capscrews and also drill and tap corresponding holes in four lengths of flat iron, which are used to clamp the gear together after it has been split, but fit the pieces on the gear before splitting it to see that all the holes line up accurately. After the gear has been cut, place it on the shaft and assemble.



File Made from Hacksaw Blades Is Non-Clogging

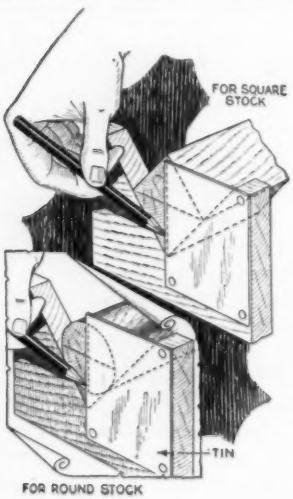


Surface Scale Can Be Quickly Removed from Molded Castings with This Hacksaw-Blade File

Rough filing on castings, etc., can be done quickly with this file made from hacksaw blades. Two tubular handles are cut and shaped as shown in the detail, and fastened to the blades with small bolts. This provides a file that will not get dull quickly and is practically non-clogging.

Improvised Center Gauge to Mark Work Accurately

A center gauge that will work accurately for either round or square stock can be made as follows: Cut a 90° V-shaped notch in a 1-in. wooden block. A piece of sheet metal is tacked to the face of the block so that one edge will bisect the 90° angle. In use, the end of the stock is placed in the notch against the metal plate, which serves both the purpose of a stop and a straightedge. Center marking is quickly accomplished by scribing two intersecting lines across the end of the stock as indicated.

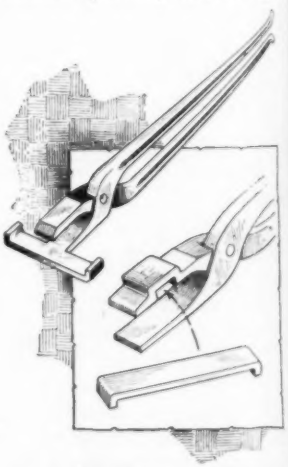


Efficiency of Drag Increased with Chains

Farmers and gardeners can utilize old chains and at the same time increase the efficiency of their drags, by fastening two or three lengths of the chain across the bottom of the drag. This will pulverize the clods that are just under the surface of the ground and otherwise would not be touched. Short lengths of chain can be used to hold self-adjusting water gaps across small streams and will be more satisfactory than hinges or wire.

Blacksmiths' Tongs Adapted to All Sizes of Work

Fitted with a number of interchangeable jaw extensions, the tongs shown herewith will cover a wide range of work. A recess is forged in one of the jaws to receive the extension pieces, which are made of 1 by ½-in. flat iron and should be a snug fit in the recess, while their length should vary to take stock of different sizes. If desired, holes may be drilled and tapped in the jaw and the extension pieces so that the latter can be held in place securely, if the edges of the recess wear down.



Babbitting a Bearing Box

Before pouring babbitt in a bearing box, brush zinc chloride over the surface to which the babbitt is to adhere, and dip in a molten solution of half-and-half solder. This tins the bearing shell, making the babbitt adhere more readily.